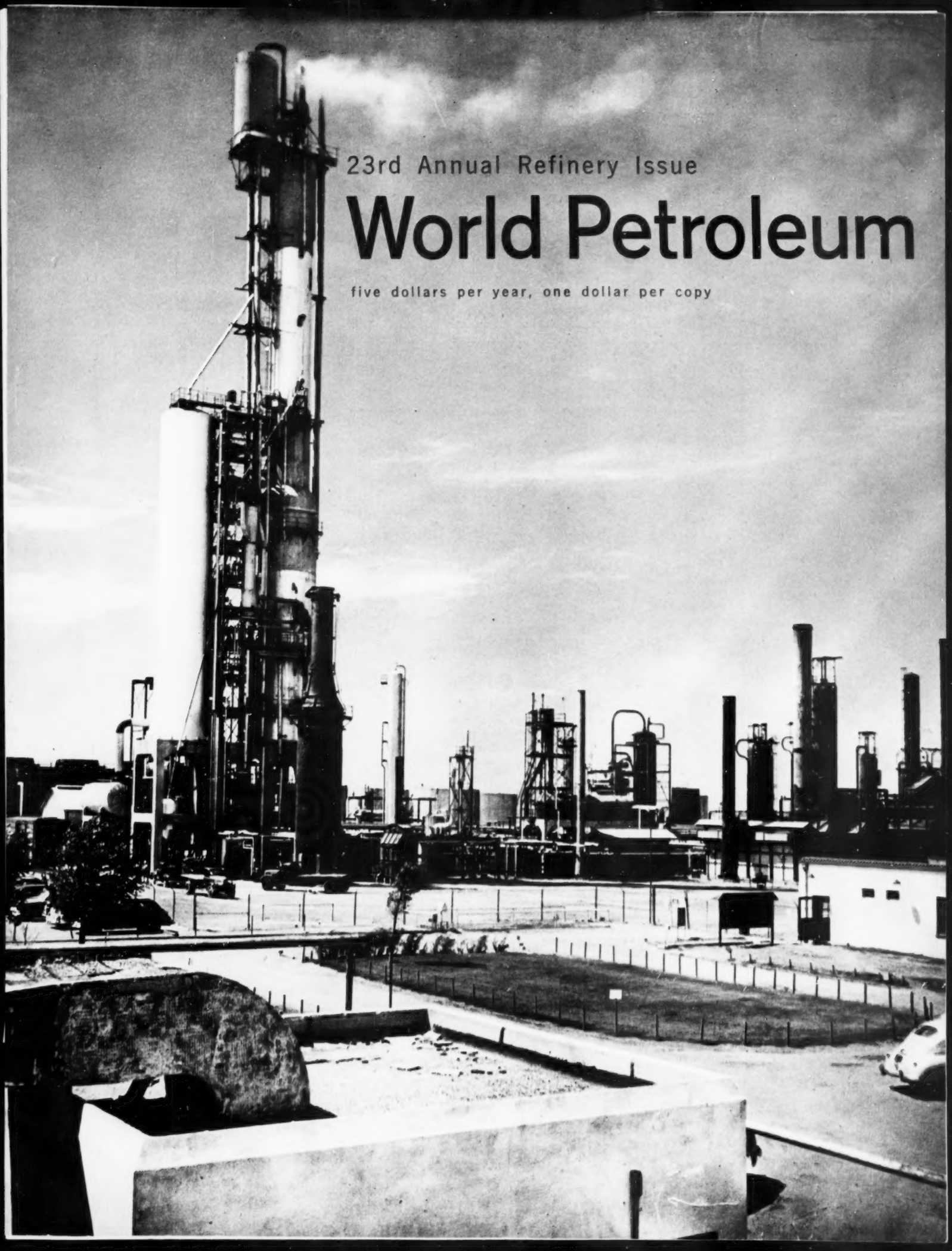

23rd Annual Refinery Issue

World Petroleum

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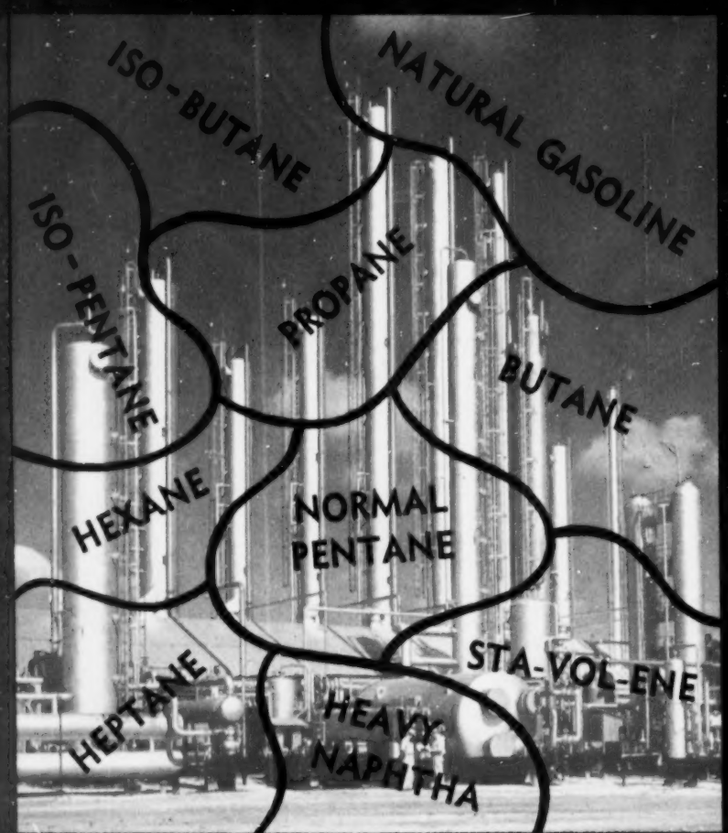
DO THESE WARREN PRODUCTS FIT INTO *Your Picture?*



NATURAL GASOLINE
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ISO-BUTANE
BUTANE
ISO-PENTANE
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WARREN

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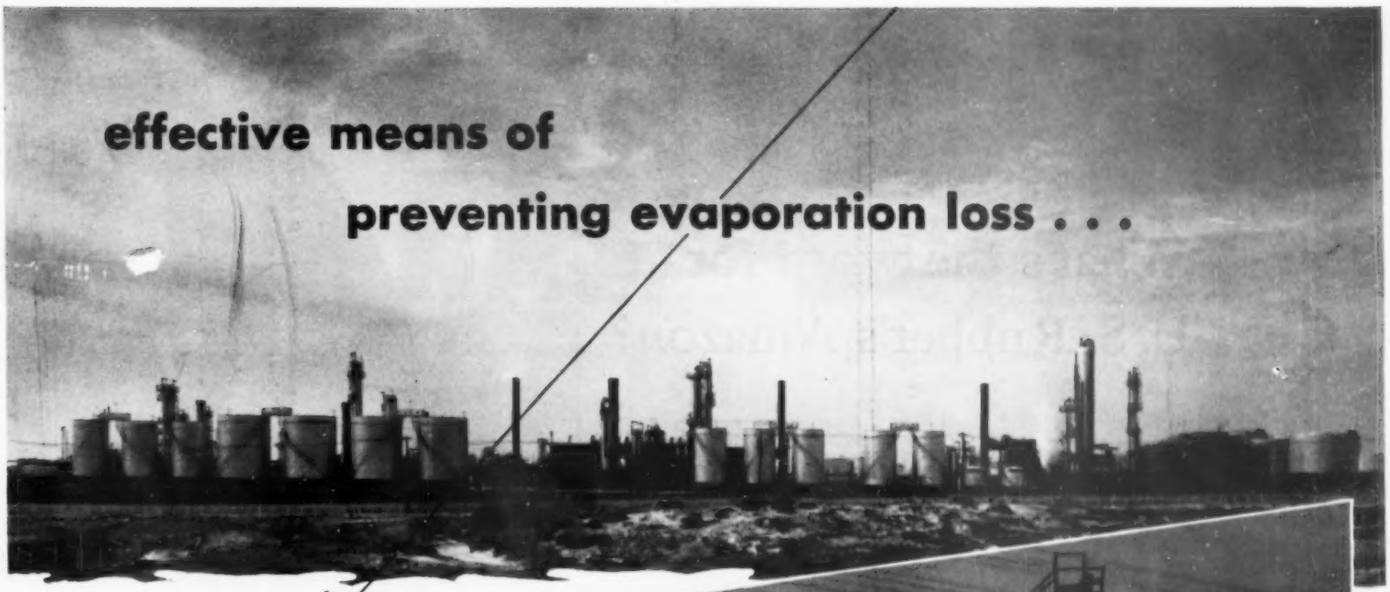
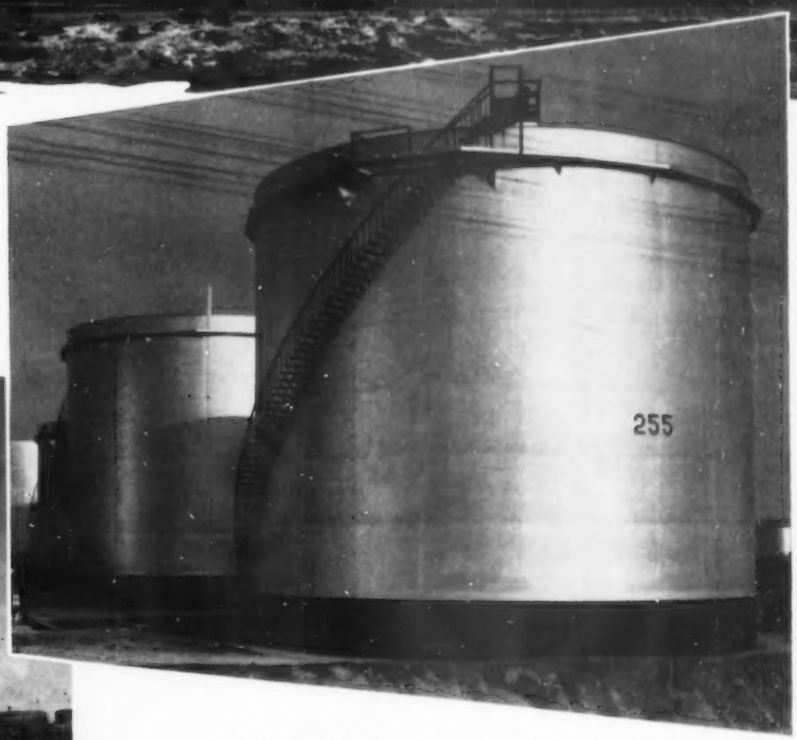
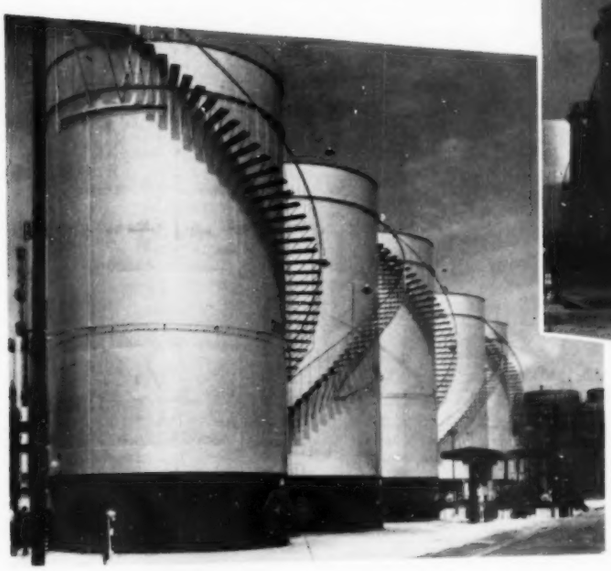
EXPORT TERMINALS: CORPUS CHRISTI, PORT ARTHUR, BAYTOWN, TEXAS CITY AND WARRENOAS, HOUSTON, TEXAS



effective means of preventing evaporation loss . . .

HORTON* FLOATING ROOFS





Top: General view of refinery showing tanks equipped with Horton Floating Roofs. Above: In the foreground are two 25,000-bbl. tanks with Horton Floating Roofs that are used for gasoline storage.

Left: Row of 2,000-bbl. tanks with Horton Floating Roofs at the California refinery.

The entire bottom of a Horton Floating Roof is normally in contact with the liquid in the tank. Space between the roof and the liquid where air-vapor mixture might form is virtually eliminated . . . and evaporation losses are prevented. Fire hazard and corrosion are also reduced as a result of the elimination of the vapor space.

The Horton Seal is used to close the space between the roof and the shell of the tank on all three types of Horton Floating Roofs. Vertical flexures every 22 inches enable the sealing ring to conform to any irregularities of the shell and form a close contact with it. The gentle, even outward thrust of the pantagraph hangers in the Horton Seal keeps the floating roof centered at all times. A gas tight, weatherproof flexible fabric closes the space between the top of the sealing ring and the roof deck.

Horton Floating Roofs are built in three types—Pan, Pontoon, and Double-Deck. Write our nearest office for information, estimates or quotations.

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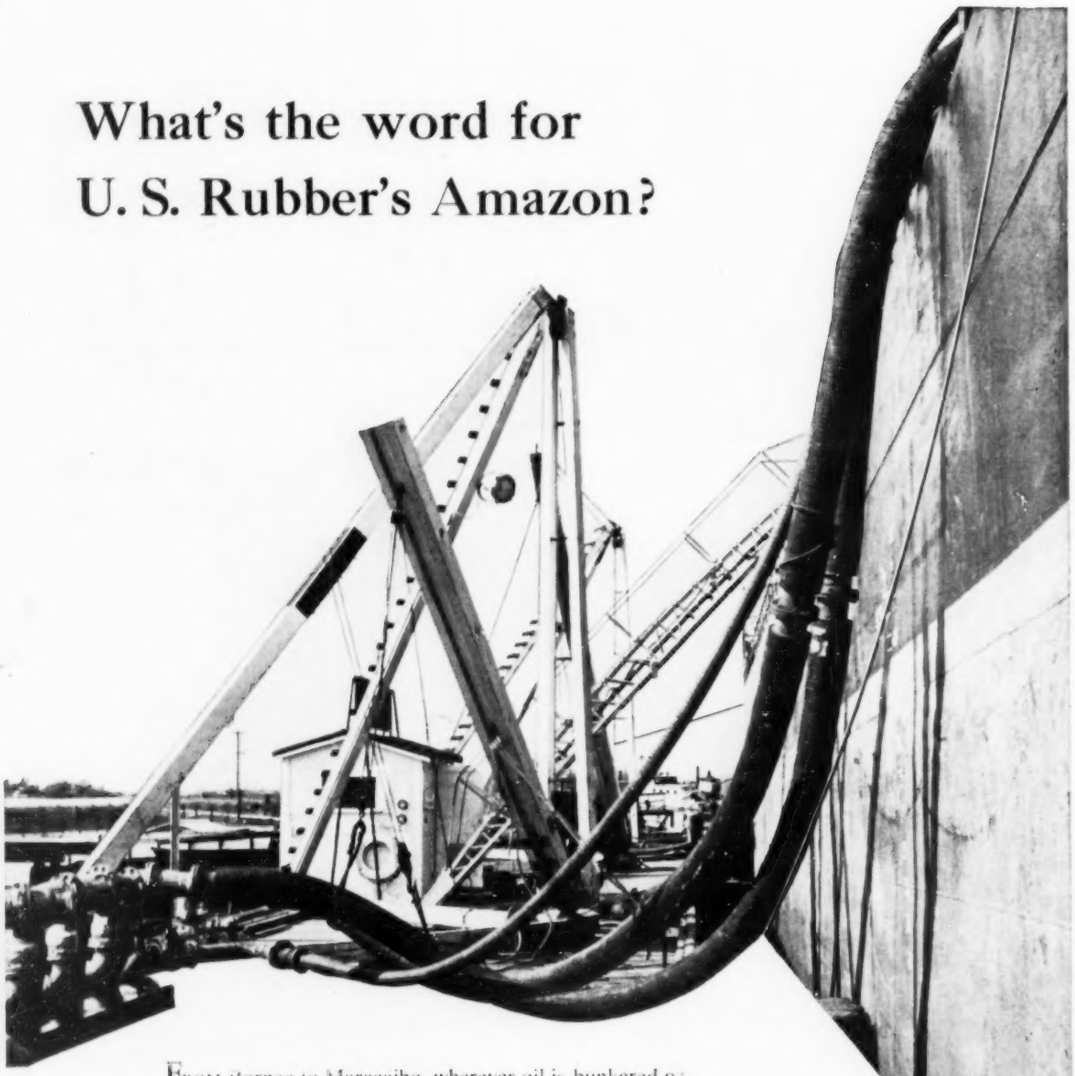
What's the word for U. S. Rubber's Amazon?



FROM Borneo to Maracaibo, wherever oil is bunkered or stored, **"rugged"** is the word for U. S. Rubber's Amazon Dock and Sea Loading Hose. From long experience, marine terminal superintendents know that the rugged strength and flexibility of Amazon oil suction and discharge hose can be counted on to give maximum service in any position, under the most severe operating conditions.

Amazon Dock and Sea Loading Hose, manufactured to identical specifications, is available from the United States, Canada and England. For complete technical data write to address below.

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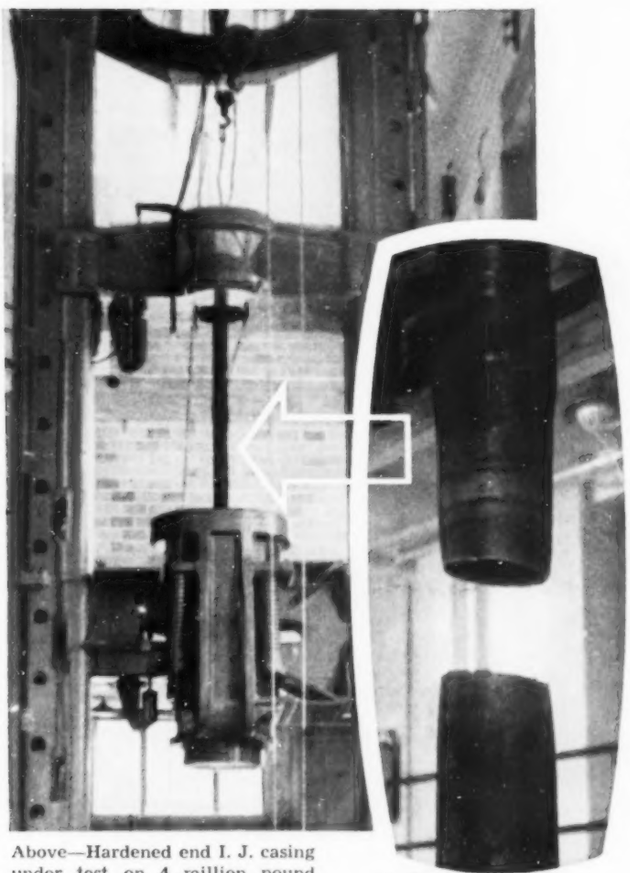
EXTRAS *that make it* BETTER



Above—Hardened end I. J. casing under test on 4 million pound testing machine at University of California. Closeup at right—Note that tested pipe broke in body, away from threaded connection.

Hardened Ends and API Threads on Youngstown Deep Well Casing

YOUNGSTOWN casing - Integral Joint and Threaded and Coupled - is produced with heat treated ends to meet the higher requirements of deep well drilling. The advantages are:

1. Controlled heat treating of ends assures homogenity of structure throughout the pipe wall.
2. Hardening makes upsets unnecessary, thus eliminates obstructions on the internal surface of the casing.
3. High joint strengths - meeting requirements of API Bulletin 5A-1 - are proven by repeated tests.
4. Integral joints improve long strings by eliminating half the threaded joints. Simplification also results as the same thread can be used for an entire string, heat treated on top, untreated on bottom. No crossover joints required.

For data on actual performance in the field, write or phone the nearest Youngstown District Sales Office.

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VALVES, FITTINGS and FLANGES

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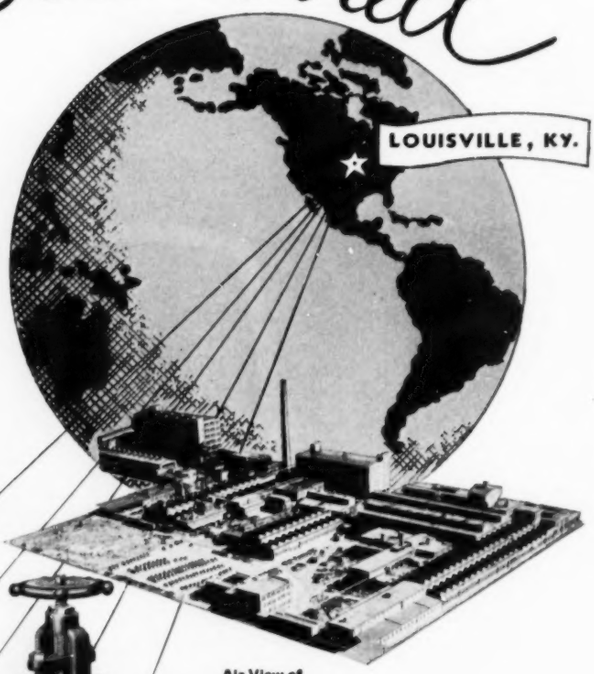

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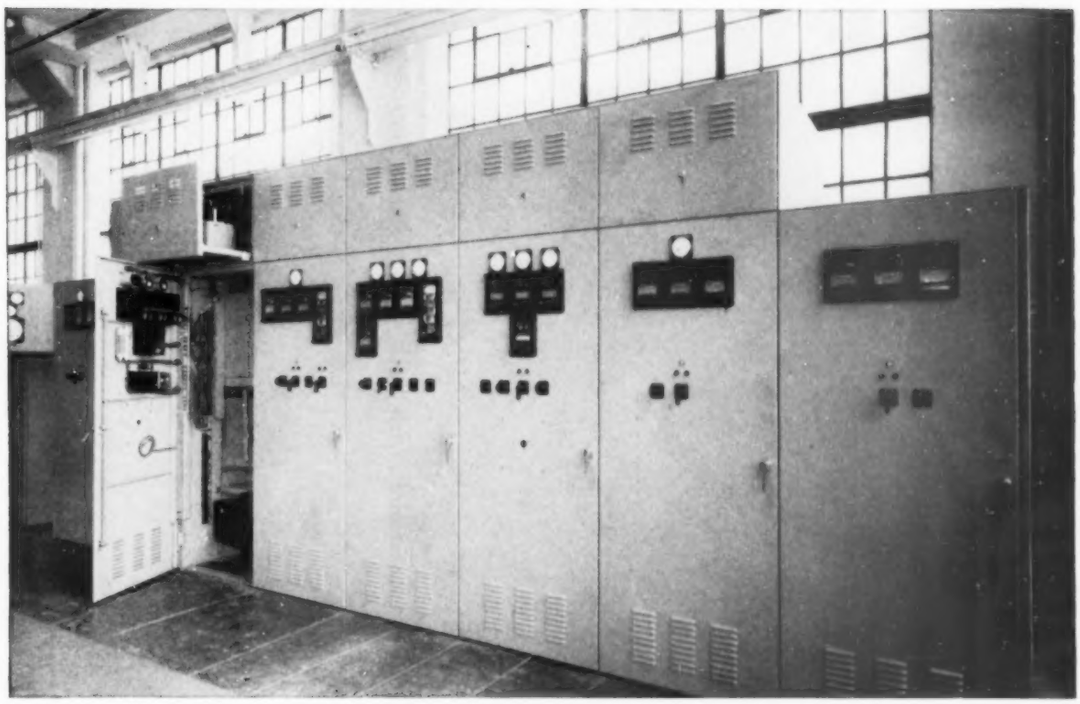

G-E Metal-Clad Switchgear Insures STRENGTH AND SAFETY!

MORE RIGID—SAFE, EASY ACCESS! Each metal-clad compartment is *all-welded*, reinforced, no bolts or rivets in frame. Solid-unit construction means greater rigidity. Control panel *hinged* for safe, easy access. Nothing to come loose. Compartment is warp-protected, too!

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New magne-blast circuit breaker has maximum number of parts interchangeable among differently-rated breakers. Easily removable breaker has operating mechanism and control relay on front, faster-acting elevating mechanism, visible primary contacts in disconnect position. Meters and relays easily removed for testing or replacing.

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BETTER VENTILATION!

All circuit components are completely ventilated with natural-draft system. Assures proper ventilation throughout equipment.

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★ ***See your G-E representative for the facts on G-E power distribution. Or write International General Electric Co., "Switchgear Specialist", 570 Lexington Ave., New York 22, N.Y., U.S.A.*** ★

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We believe this thirty years of experience is one of the most important ingredients in Ethyl antiknock service. For while one pound of antiknock compound may be very much like another—its value to the refiner depends largely on how it is used. From the very beginning, Ethyl has had as its principal objective not only the efficient manufacture of a product, but the development of services which would help our customers get the most out of that product.

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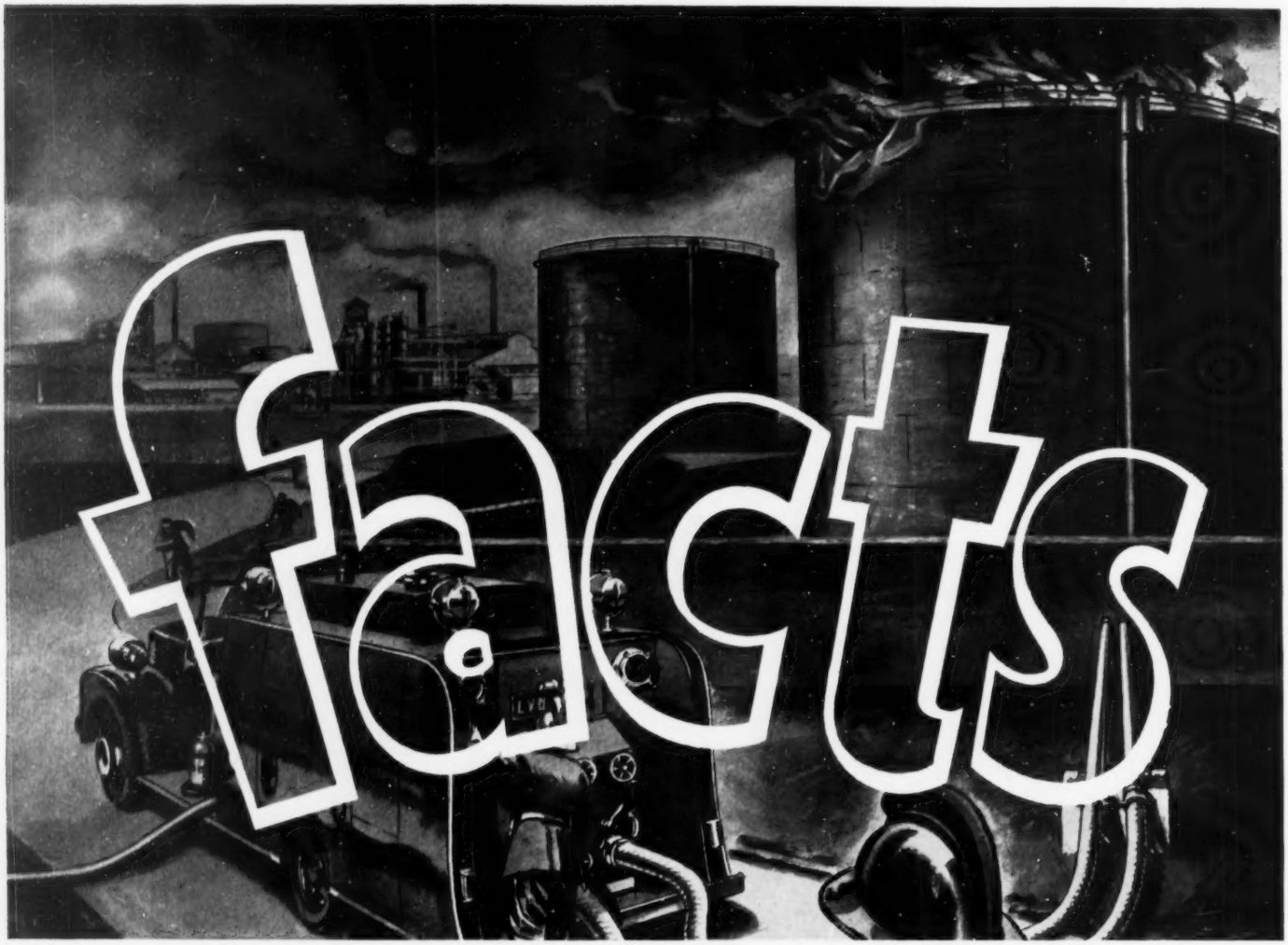
These services are doubly valuable because the men who bring them to you have many years of personal experience. Many of our people wear service pins indicating five, ten and twenty-five years of working with Ethyl for the petroleum industry.

ETHYL CORPORATION, New York 17, N. Y.

Ethyl Antiknock Ltd., in Canada



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1 For the extinction of large oil and spirit fires, Mechanical Foam is acknowledged to be most effective of all Fire-fighting agents.

2 The best possible foam is that produced by "Pyrene" Foam-making Compound used in conjunction with "Pyrene" Foam Generating Equipment.

3 Thus Foam not only extinguishes the flames, but its stability and viscosity are sufficient to resist extreme heat, thus providing a protective "blanket" against re-ignition.

4 "Pyrene" Foam-making Compound is manufactured in four grades, i.e.—Standard Compound, Low Viscosity Compound, Alcohol-resistant Compound (specially effective against fires involving alcohols), and Pre-mix Compound for use in equipment where a ready-mix solution of compound and water is required.

5 The comprehensive range of "Pyrene" Portable, Mobile and Fixed Fire Protection Equipment provides the right safeguard against every type and size of oil and spirit fire risk.

6 The elimination of long runs of pipe-line, plus the ease with which "Pyrene" Mechanical Foam Systems are applied to modern oil tank and refinery requirement combine to give economy with the highest efficiency.

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Gherilah ibn Saud *has* الخبرة الفنيّة

الخبرة الفنيّة is the Arabic for KNOW-HOW which the world over is the key to good jobs, good pay and family security.

Gherilah, an assistant surveyor, is employed by the Arabian American Oil Company in Saudi Arabia. He got his know-how at ARAMCO training schools. Almost 15,000 of his countrymen hold jobs with ARAMCO and more than half of them are enrolled in classes to learn special oil industry skills.

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X Marks a BIG Difference

IN 300-POUND STEEL GATE VALVES

There's a lot of pioneering wrapped up in Crane 300-Pound Cast Steel Wedge Gates—pioneering that helped set the high quality standards every modern steel valve must meet.

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And yet, Crane still manages to come up with "X" trim of superior quality. It's done with bars and billets that meet the most rigid specifications—and manufacturing techniques that develop the best characteristic of material for each component part.

And it's you, the Thrifty Valve Buyer, who benefits from Crane Co.'s pioneering experience. You get better quality steel valves—quality that keeps up performance and holds down maintenance costs.

Crane 300-Pound Cast Steel Gate Valves are available in a wide range of sizes with 3 different end connections. See your Crane Catalog or call your Crane Representative.

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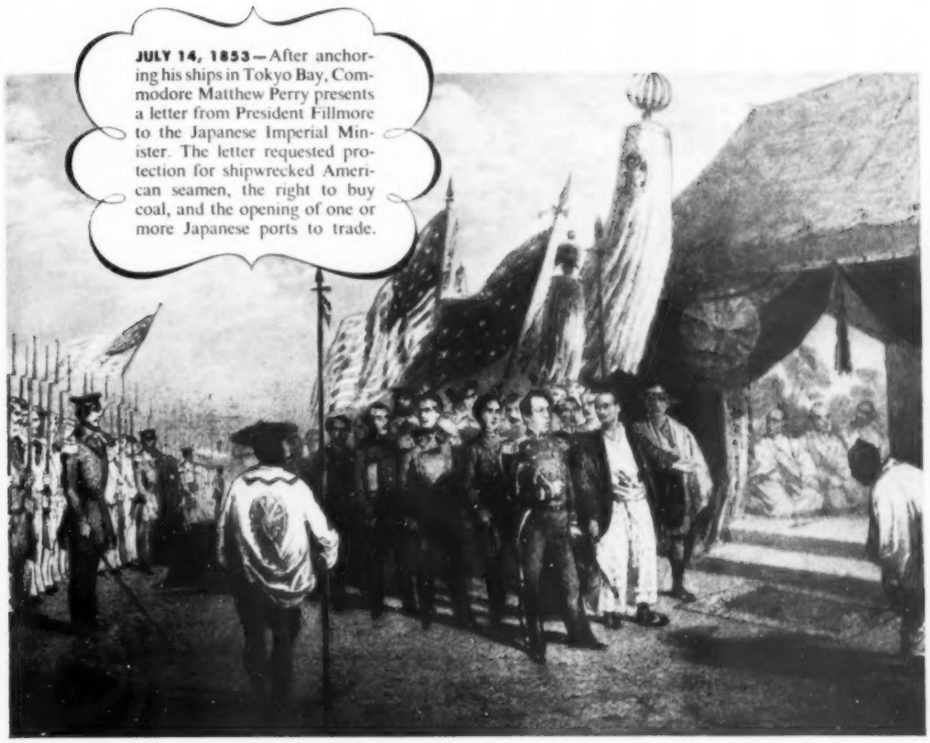
VALVES · FITTINGS · PIPE · PLUMBING · HEATING


JULY 14, 1853—After anchoring his ships in Tokyo Bay, Commodore Matthew Perry presents a letter from President Fillmore to the Japanese Imperial Minister. The letter requested protection for shipwrecked American seamen, the right to buy coal, and the opening of one or more Japanese ports to trade.

1853—Commodore Perry opens the Orient; Worthington begins its world trade operations

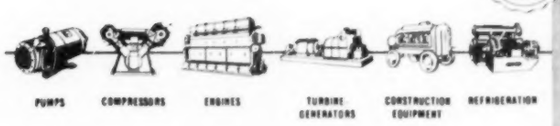
Thanks to Commodore Perry's efforts, the Orient opened its doors to world trade in 1853.

In that same year, the first recorded Worthington export sale was made: a Worthington pump was installed in the King's Cross Station in London, England.

Today, one hundred years later, Worthington has offices and representatives in every quarter of the globe, and Worthington's emblem and products are known wherever engineering science has made its mark. Leaders in industry and in the marine, agriculture, power and construction fields know that Worthington equipment will give them efficient service under the severest operating conditions.

In projects ranging from rice field irrigation in Thailand to the pumping of oil in Arabia, Worthington has assisted in developing natural resources and raising the standards of living everywhere. Worthington factories in Europe and Latin America help bring the benefits of modern machinery to people all over the world.

Write for a free copy of "World-Wide Operations" telling of Worthington facilities around the world. Worthington Corporation, Export Department, Harrison, New Jersey, U. S. A. F.3.1



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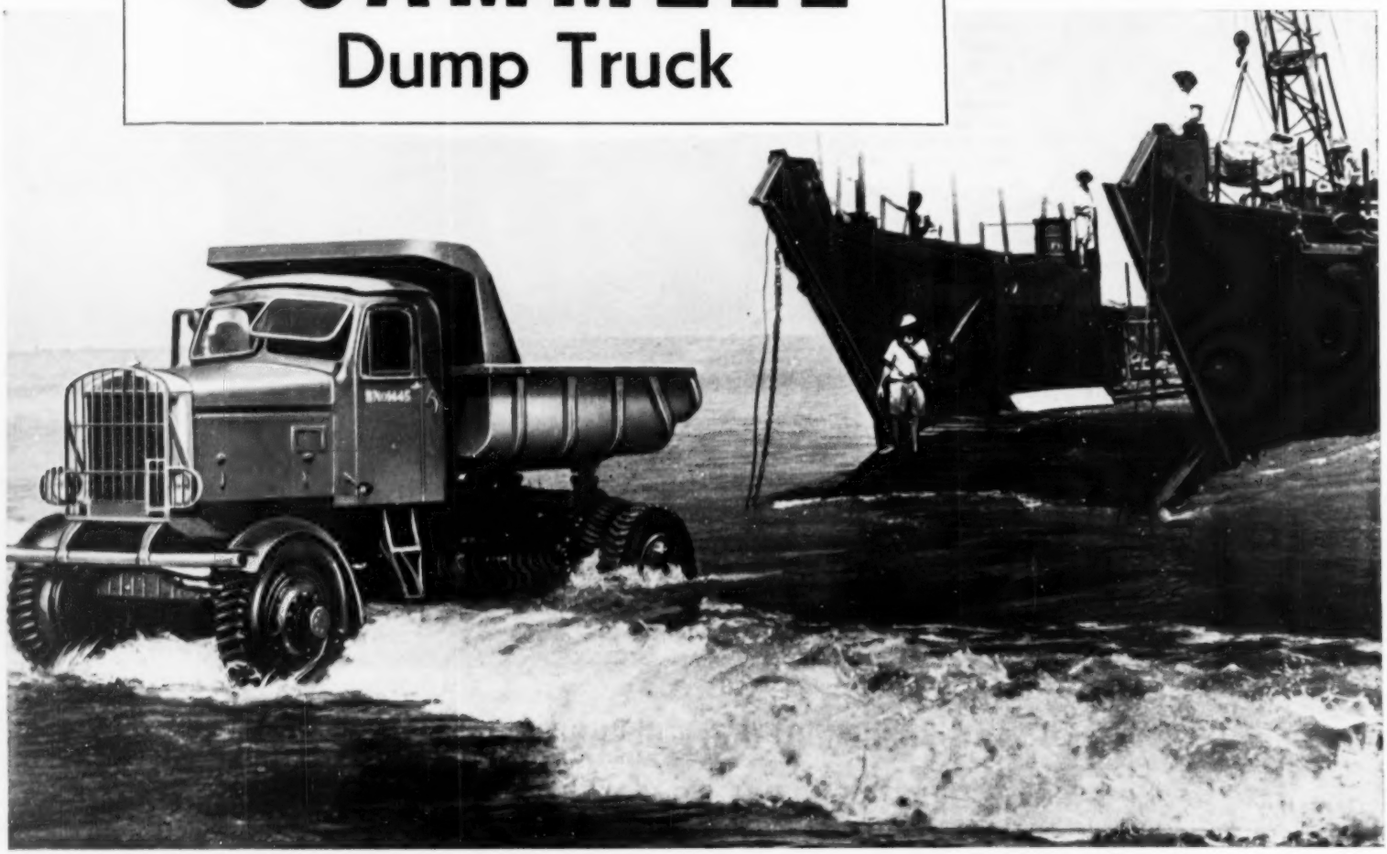
The Sign of Value Around the World

The SCAMMELL Dump Truck



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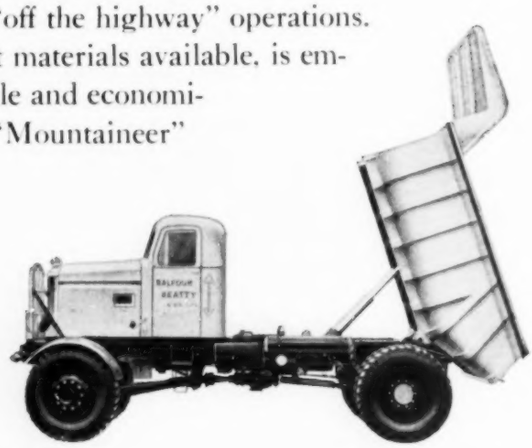
The Scammell "Mountaineer" four-wheel drive Dump Truck has been exclusively designed to meet arduous demands of some "off the highway" operations. Sound engineering practice, coupled with the finest materials available, is embodied in a vehicle that will give long life and reliable and economical service during the toughest assignments. The "Mountaineer" 4 x 4 is also available as a Tractor and Load Carrier with varying wheelbases.



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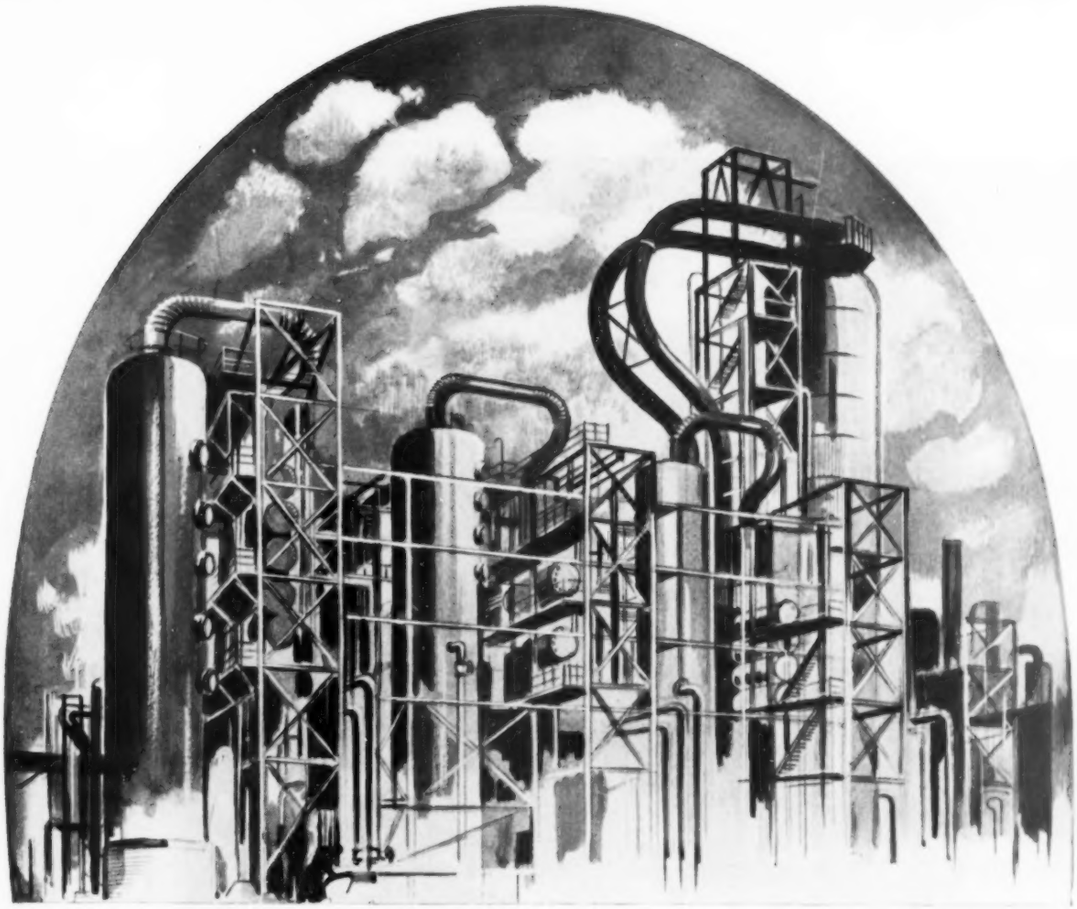

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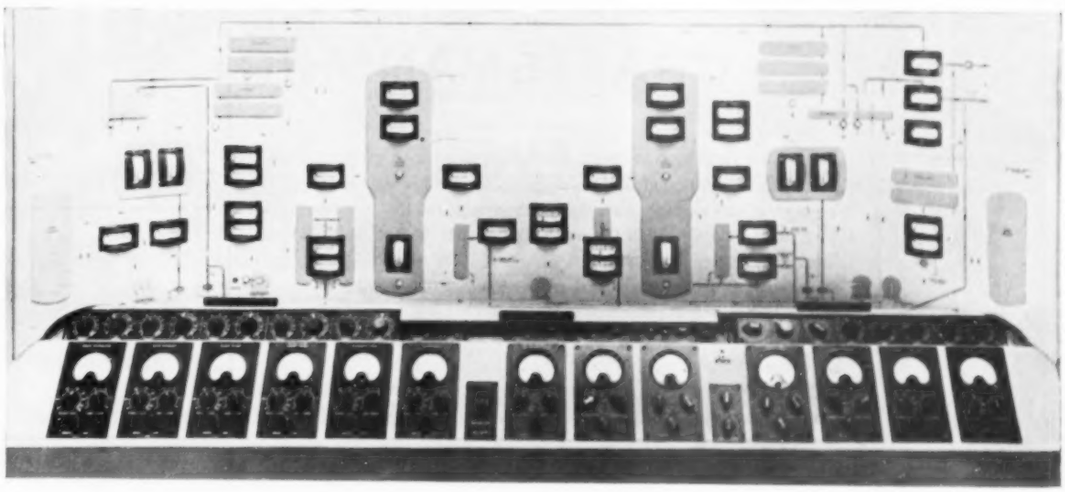
Complete automatic control of process plant over considerable distances and without signal lag.

Mimic panels with miniature indicators, integrators and chart recorders, and with control knobs for 3-term action included in the diagram, if desired.

Two recently completed refineries are equipped with this modern form of control and orders for other refineries are in hand.



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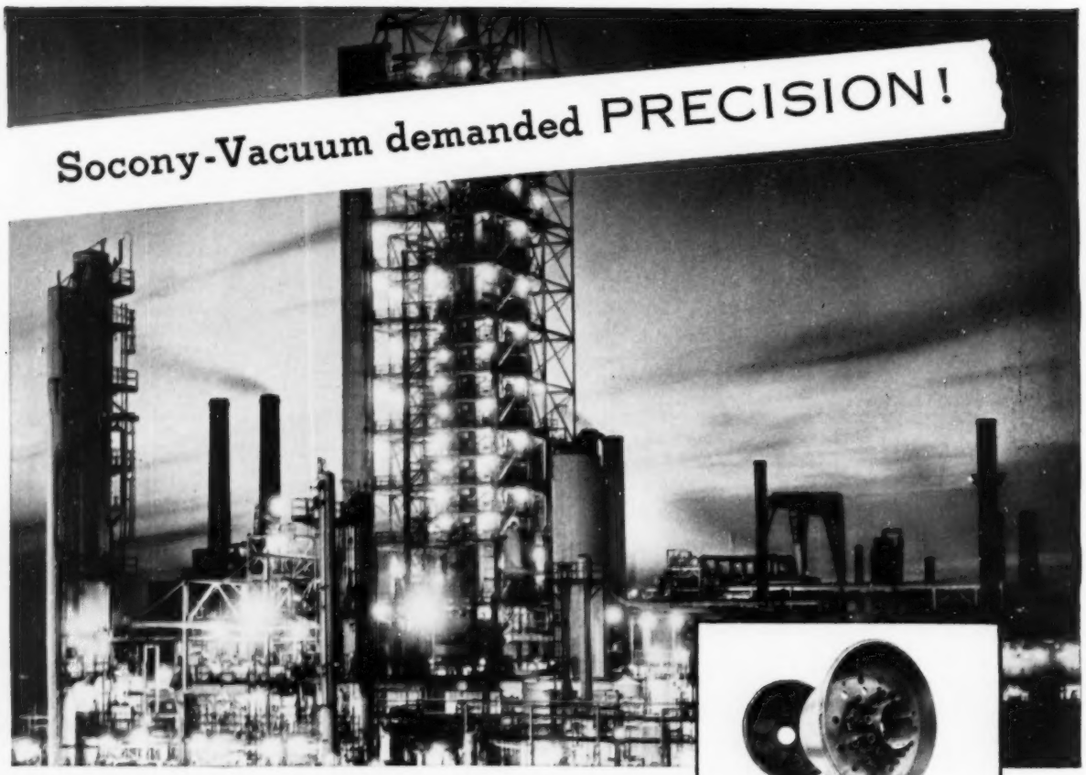
Socony-Vacuum demanded PRECISION!



...and called on GRAVER

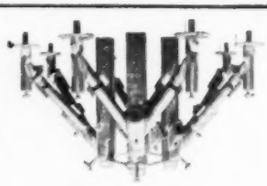
CRAFTSMANSHIP

For years Graver has been a leading producer of specialized fabrications for the petroleum industry. One of the reasons why can be seen in the various units Graver has built for Socony-Vacuum's Thermofor Catalytic Cracking installations. These installations incorporate their exclusive air-lift design for which Graver constructed the intricate fabrications pictured on the right.

These units are essential parts of a revolutionary design, the features of which Socony-Vacuum has recently adapted to small refineries, employing the same general principles.

Thus does Industry continue to depend on Graver for superior craftsmanship in steel plate fabrication.

Separator-surge hopper



Catalyst Feed Lines

Lift Pot

Primary Air Nozzle

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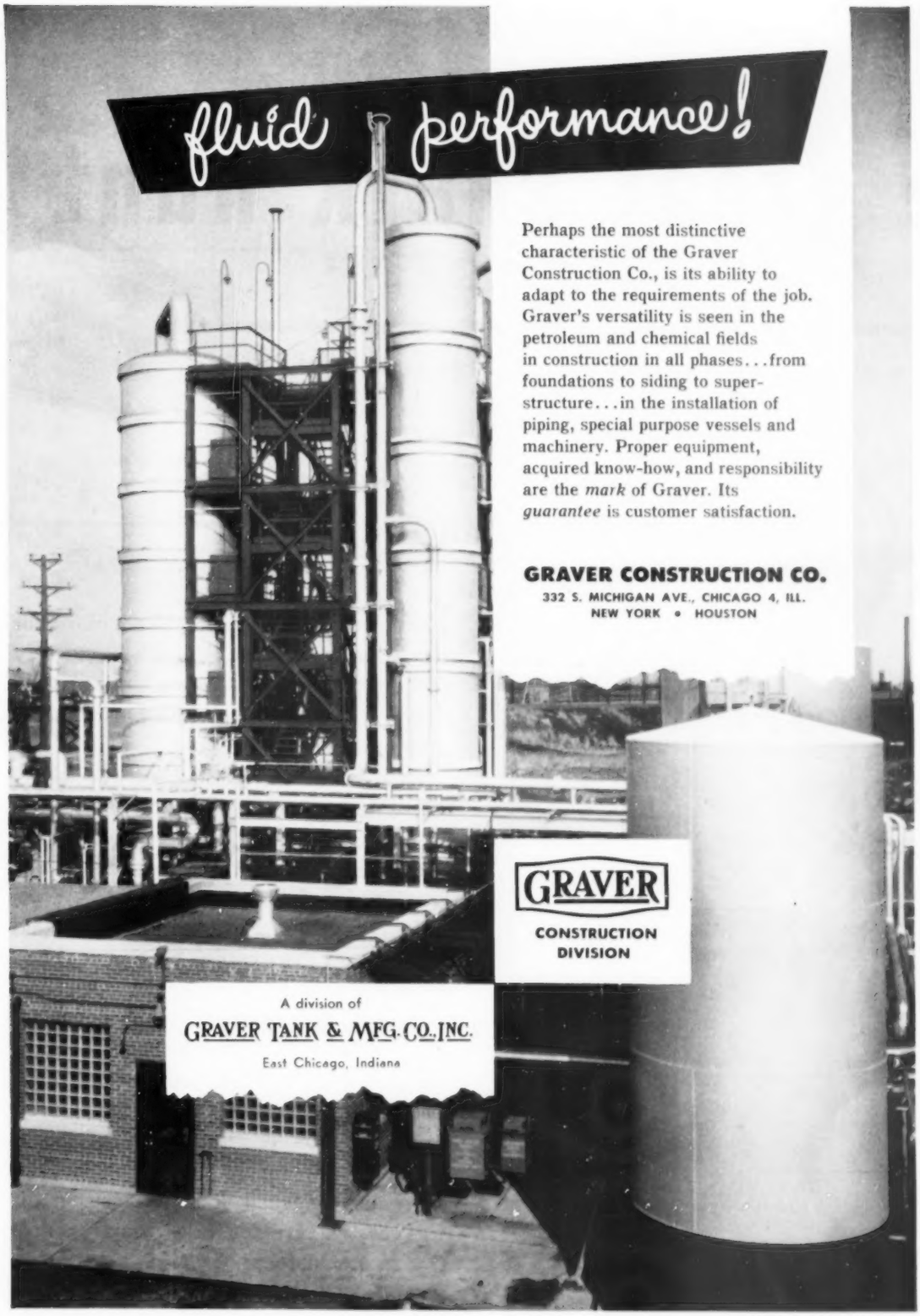
fluid performance!
Perhaps the most distinctive characteristic of the Graver Construction Co., is its ability to adapt to the requirements of the job. Graver's versatility is seen in the petroleum and chemical fields in construction in all phases...from foundations to siding to superstructure...in the installation of piping, special purpose vessels and machinery. Proper equipment, acquired know-how, and responsibility are the *mark* of Graver. Its *guarantee* is customer satisfaction.
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the great snark hunt

LOOKING FOR OIL is often like looking for the snark, a creature which has one very odd characteristic: it doesn't exist at all.

For oil is just about the most elusive prey on earth.

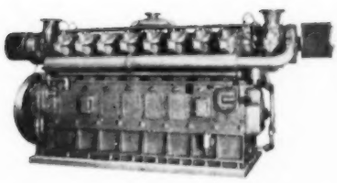
In spite of the difficulties of seeking something which very often isn't even there, Cities Service geologists have participated in opening up some of the greatest oil fields in America . . . the Oklahoma City, Eldorado, Kansas and East Texas discoveries, to name a few.

As you read this, Cities Service geologists are tramping over Canadian tundra, wading through Louisiana marshes, climbing mountains, breathing desert dust, seeking—and finding—oil for the rapidly growing needs of your home, factory, farm and automobile.

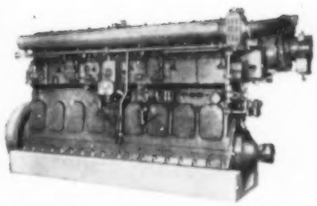
Because of such men, America's oil reserves are greater now than at any time in our history.

CITIES SERVICE

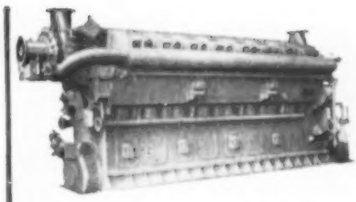
Quality Petroleum Products



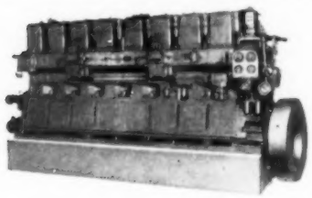
TYPE FVA ..... 8, 12 or 16 cyl.
Diesel — Atmospheric ..... 430 to 1150 hp.
Diesel — Supercharged ..... 1110 to 2230 hp.



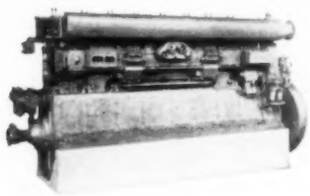
TYPE LS ..... 6, 7 or 8 cyl.
Atmospheric and Supercharged
Gas ..... 720 to 2500 hp.
Diesel ..... 825 to 2500 hp.
Gas-Diesel ..... 825 to 2500 hp.



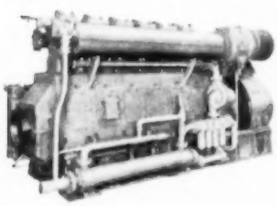
TYPE LSV ..... 12 or 16 cyl.
Atmospheric and Supercharged
Gas ..... 1440 to 5000 hp.
Diesel ..... 1650 to 5000 hp.
Gas-Diesel ..... 1650 to 5000 hp.



TYPE JS ..... 5, 6, 7 or 8 cyl.
Atmospheric and Supercharged
Gas ..... 375 to 1815 hp.
Diesel ..... 430 to 1815 hp.
Gas-Diesel ..... 430 to 1815 hp.



TYPE GS ..... 5, 6 or 8 cyl.
Atmospheric and Supercharged
Gas ..... 320 to 1460 hp.
Diesel ..... 300 to 1460 hp.
Gas-Diesel ..... 300 to 1460 hp.



TYPE FW ..... 6 cyl.
Diesel — Atmospheric ..... 245 to 500 hp.
Diesel — Supercharged ..... 350 to 835 hp.

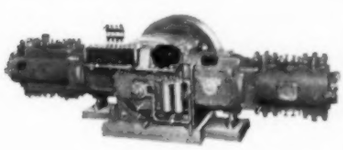
it pays to meet power and compressor needs "right on the nose" . . with COOPER-BESSEMERS

• Think a moment about the importance of meeting engine or compressor needs with machines that are exactly *right* for the job. With Cooper-Bessemers you have this assurance, as evidenced by the broad range of units shown here — all standard, proved Cooper-Bessemers, engineered to give *maximum* return in any kind of service you can name, from 300 to 5,000 bhp. Note, too, the flexibility offered by each basic engine type — in number of cylinders, aspiration, horsepower range and fueling.

As important as these things are in meeting your requirements without needless waste *or* shortcomings, Cooper-Bessemers have long been known for additional plus values . . . sturdiness, long life, low maintenance and unmatched efficiencies for lower over-all cost every time! There are new bulletins, yours for the asking, to give you the latest information on Cooper-Bessemer engines or compressors just right for your needs.

MOUNT VERNON, OHIO
COOPER-BESSEMER
GROVE CITY, PENNA.

New York Washington, D. C. Bradford, Pa. San Francisco Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle Shreveport St. Louis Los Angeles Chicago
Cooper-Bessemer of Canada, Ltd., Edmonton, Alberta Tulsa Gloucester, Mass. New Orleans, La.



TYPE EM
To 350 hp.
9" stroke
Speed to 514 RPM

TYPE FM
To 1500 hp.
10½" stroke
Speed to 514 RPM

TYPE JM
500 to 3000 hp.
14" stroke
Speed to 327 RPM

Matthew Hall & Co., Limited

The Twenty-Sixth Annual General Meeting of Matthew Hall & Co. Limited was held on 18th May, 1953 at 26 Dorset Square, London.

Mr. Bertram Baden, M.C., S.B.St.J., M.I.H.V.E., the Chairman, presided.

The following is his statement which was circulated with the report and accounts:

PROFIT AND LOSS ACCOUNT.—I am happy to report that 1952 has been another successful year. Although the increase in turnover continued there has been a large reduction in the amounts outstanding on the contracts in progress and on other balances due to the Company, resulting in a decrease in the Bank overdraft.

The Group Profit on Trading was £190,067 (1951 £167,659) from which Directors' Remuneration, Bank Interest, Depreciation and Provision for Deferred Repairs amounting to £85,833 (1951 £73,990) must be deducted, leaving a Net Profit before taxation of £104,234 (1951 £93,669).

The Parent Company has placed £10,119 to General Reserve and the Directors recommend a dividend of 20%. The amount carried forward in the Group accounts is £104,516 (1951 £82,423).

AIR CONDITIONING.—Air conditioning at home and overseas includes installations in connection with such diverse undertakings as broadcasting studios in the West Indies, a library in Ireland, textile spinning shops, oil refineries, hospitals, lithographic engraving, chemical engineering, and what may be the largest Government contract placed in this country for air conditioning.

For dust extraction we have designed and installed a revolutionary scheme which provides appreciable savings in both initial and running costs.

Last winter we experienced one of the worst fogs in recent years and there have been enthusiastic reports on the efficiency of our air conditioning installations including that at the Royal Festival Hall.

ELECTRICAL.—At an oil refinery we are carrying out lighting, power and earthing installations to jetties and pumphouses, M.E.K., furfural, clay contact and hot oil units, main boiler house, power control building, sub-stations, waste water oil separators, also line heating and instrumentation.

At a plant for bromide extraction, ethylene conversion and production of di-bromide, we are installing instrumentation which includes approximately 300 pneumatic and electrical instruments and control valves, air and fluid lines and electrical wiring.

CHEMICAL, OIL REFINERY AND INDUSTRIAL ENGINEERING.—Our work for the major oil and chemical companies continues and during the year we have carried out a number of large contracts for the erection of plant and process pipework.

At several Power Stations we have received further orders to instal plant and pipework including boilers, cooling water towers and electric generating plant.

For the first phase of the new alumina plant in the West Indies, we erected nearly 20 miles of pipework and installed more than 70 pumps and over 100 motors up to 150 h.p. and other plant.

In passing, it is interesting to note that the value of clients' own equipment and their special plant entrusted to us for installation during the year amounts to over £8,000,000.

PLUMBING AND GARCHEY SYSTEM.— Orders have been received throughout the year for plumbing installations both large and small, and this side of the business continues to do well. We are engaged on housing contracts all over the British Isles.

It is a pleasure to tell you that our apprentice plumbers won the Apprenticeship Council's Cup for the fourth time in five years.

Further contracts have been received for the Garchey system of Domestic Refuse Disposal and installations will be operating in London, Leeds, Birmingham and Newcastle.

SOUTHERN RHODESIA.— A branch has been opened in Bulawayo and a site for a factory and offices acquired; building should commence shortly.

MATTHEW HALL (PTY.) LTD., SOUTH AFRICA.—This company extended its activities during the year to work on the Union's uranium projects; this included the fabrication and manufacture of pipework up to 30" diameter, and leadburning contracts for sulphuric acid plants. A growing number of contracts in all our other fields were executed, the automatic sprinkler installations being particularly successful.

The company's fourth branch office and factory in South Africa was opened at Cape Town and the Durban factory went into full production.

As yet they have received contracts for £1,500,000 worth of work in the gold fields area of the Orange Free State.

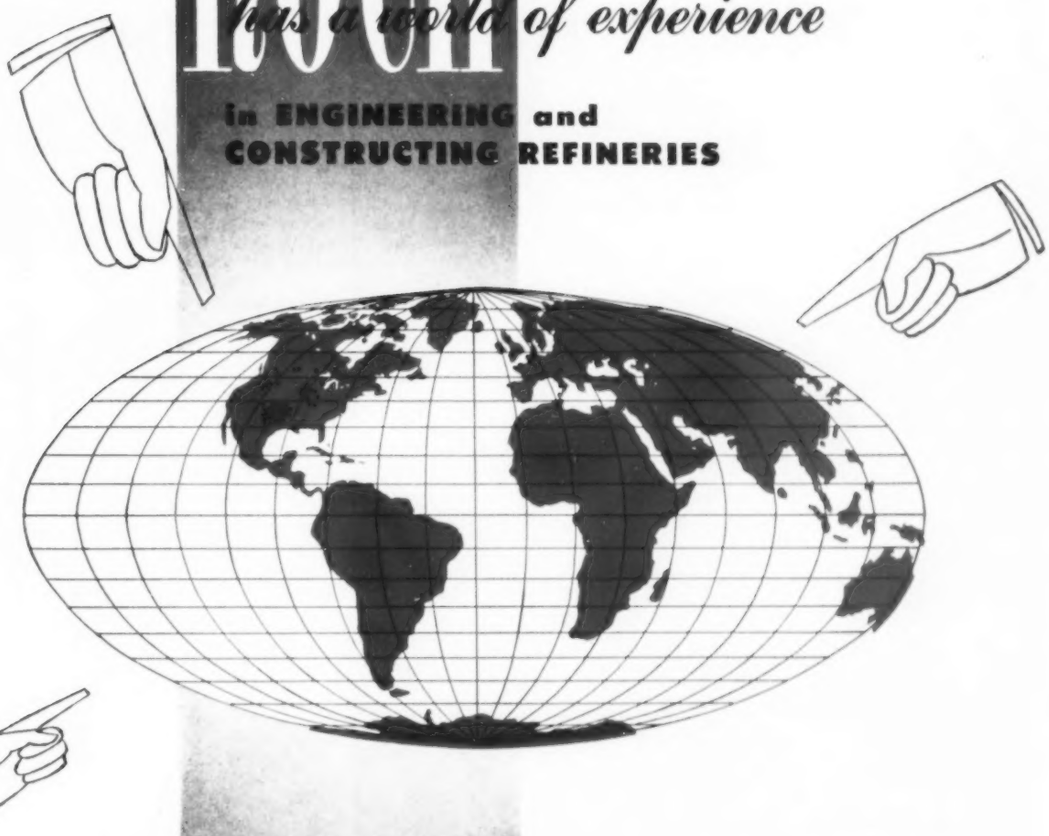
It gives me great pleasure once again to publicly express the thanks of the Board to all members of our Organisation for their efforts and loyal service during the year.

The report and accounts were adopted.

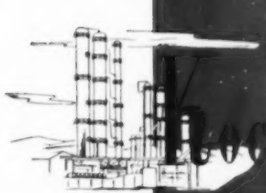
KOCH

has a world of experience

in ENGINEERING and CONSTRUCTING REFINERIES



From West Texas to India, and from Canada to South Africa, Koch has earned a reputation for engineering and constructing refineries. Koch combines top-flight engineering talent with practical refinery experience to provide the most flexible unit for a minimum investment. You have a standing invitation to "call on Koch" to discuss your next refinery project.



KOCH ENGINEERING COMPANY, INC.

DESIGNERS • MANUFACTURERS • BUILDERS
221 WEST DOUGLAS • WICHITA 2, KANSAS

BRITISH ASSOCIATES • MESSRS. A. F. CRAIG & CO., LTD., PAISLEY, SCOTLAND

STEEL CHIMNEY SHAFTS

with

RE-INFORCED CONCRETE CASINGS

Height 120 ft. **Diameter 6 ft.**

Built for Fraser & Chalmers Engineering Works (Proprietors: The General Electric Co. Ltd.) Erith, Kent.

During the last 40 years Tileman's have designed and constructed re-inforced concrete chimneys for every kind of industrial undertaking. Up to date they have built nearly 200 chimneys, in countries as far apart as England and Australia, ranging up to a height of 480 feet in that constructed at Oran in 1950.

TILEMAN & COMPANY LTD.

RE-INFORCED CONCRETE ENGINEERS & CONTRACTORS

203 KNIGHTSBRIDGE, LONDON, S.W.7, ENGLAND

TELEPHONE: KENSINGTON 0134 CABLES: "TILEMANO, LONDON."

Westinghouse Controls Stand Guard

for the Mene Grande "Navy"

Maintenance men ride to work in power launches at Mene Grande's 500-well underwater oil field on Lake Maracaibo in Venezuela. At many of the wells their job is a lot easier because Westinghouse automatic controls stand guard 24 hours a day over continuously operating pumping motors.

This weatherproof oil well pumping control for single-speed, squirrel-cage motors has proved its dependability in operations where it is impractical to post a man at each well. Providing across-the-line motor starting with complete overload and low-voltage protection, this Westinghouse control does more than merely trip off when trouble develops. If a temporary overload occurs, the control keeps the motor operating. If the overload persists, however, the control shuts down the motor before the danger point is reached. Control cabinet is suitable for surface or pole-mounting.

An optional feature of the control which pays big dividends in multi-well operations such as the Mene Grande field is the Westinghouse AM Relay Timer. This prevents system overloads after power failure by automatically restarting motors in staggered sequence.

We'd like to tell you more about this automatic pumping motor control as well as other Westinghouse equipment for oil field electrification. Write for your free copy of our new booklet B-4039.

YOU CAN BE **SURE** ...IF IT'S

Westinghouse

WESTINGHOUSE ELECTRIC INTERNATIONAL COMPANY

40 Wall Street, New York 5, U. S. A.

Larger Bore....

Heavier Steel Fluid End....

in Bethlehem Slush Pumps

Now, in all the four top sizes of Bethlehem slush pumps, you get a larger bore to accommodate an 8-in. liner. This means greater volume, of course. And all four sizes are equipped with heavy, massive fluid ends to withstand the pressures of modern drilling. It's a Bethlehem *plus* – extra volume at those extra-high pressures.

These pumps are mighty rugged. Even the 225, smallest of the group, is a powerhouse. And the 600, head man of the lot, is the biggest, strongest unit Bethlehem has ever offered.

There are many features common to all – features that add to the smoothness, long life, and overall efficiency of the pumps. For example: complete oilbath lubrication (trouble-free!). And roller bearings throughout. And such important details as API metal ring gaskets on valve covers, suction flanges, discharge flanges, stuffing boxes.

We can't possibly tell you the full story in this small space. But any time you say, a Bethlehem engineer will be glad to go over the units with you, point by point. There's a Bethlehem pump for every drilling job you have. Write for information; complete details will be sent promptly.

CHOOSE YOUR PUMP FROM THESE FOUR SIZES:

Input Hp.	Bore & Stroke
225	8 in. x 14 in.
325	8 in. x 16 in.
450	8 in. x 16 in.
600	8 in. x 18 in.

A complete line for depths ranging from 3500 ft. to maximum.

Bethlehem also manufactures a complete line of drawworks, crown and traveling blocks, swivels, and rotary tables; and, for production work, pumping units in a wide range of sizes and types. Write for full information.

BETHLEHEM STEEL

BETHLEHEM STEEL EXPORT CORPORATION

25 Broadway, New York 4, N.Y., U.S.A.

Cable Address "BETHLEHEM, NEWYORK"

all asbestos

is only half the story

CAPOSITE insulation is not just all-asbestos. It is *all-amosite;* amosite being the uniquely long-fibred asbestos—from the Cape Asbestos Co. Ltd's own mines—which makes possible CAPOSITE'S particularly open, cellular texture. This texture gives it a level of thermal insulation which saves over 98 per cent of uncovered hot surface losses, plus a resistance to the severest conditions of steam heat which enables it to maintain this efficiency almost indefinitely. CAPOSITE pre-formed pipe-sections and slabs are extremely strong, yet light and easy to fit; non-corrosive; and exceptionally economical. Write for full details.

CAPOSITE

100% PURE ASBESTOS INSULATION

The Cape Asbestos Co. Ltd., 114-116 Park Street, London, W.1. Tel: GROsvenor 6022

NEWMAN - McEVOY VALVES

GIVE EFFICIENT DEPENDABLE SERVICE

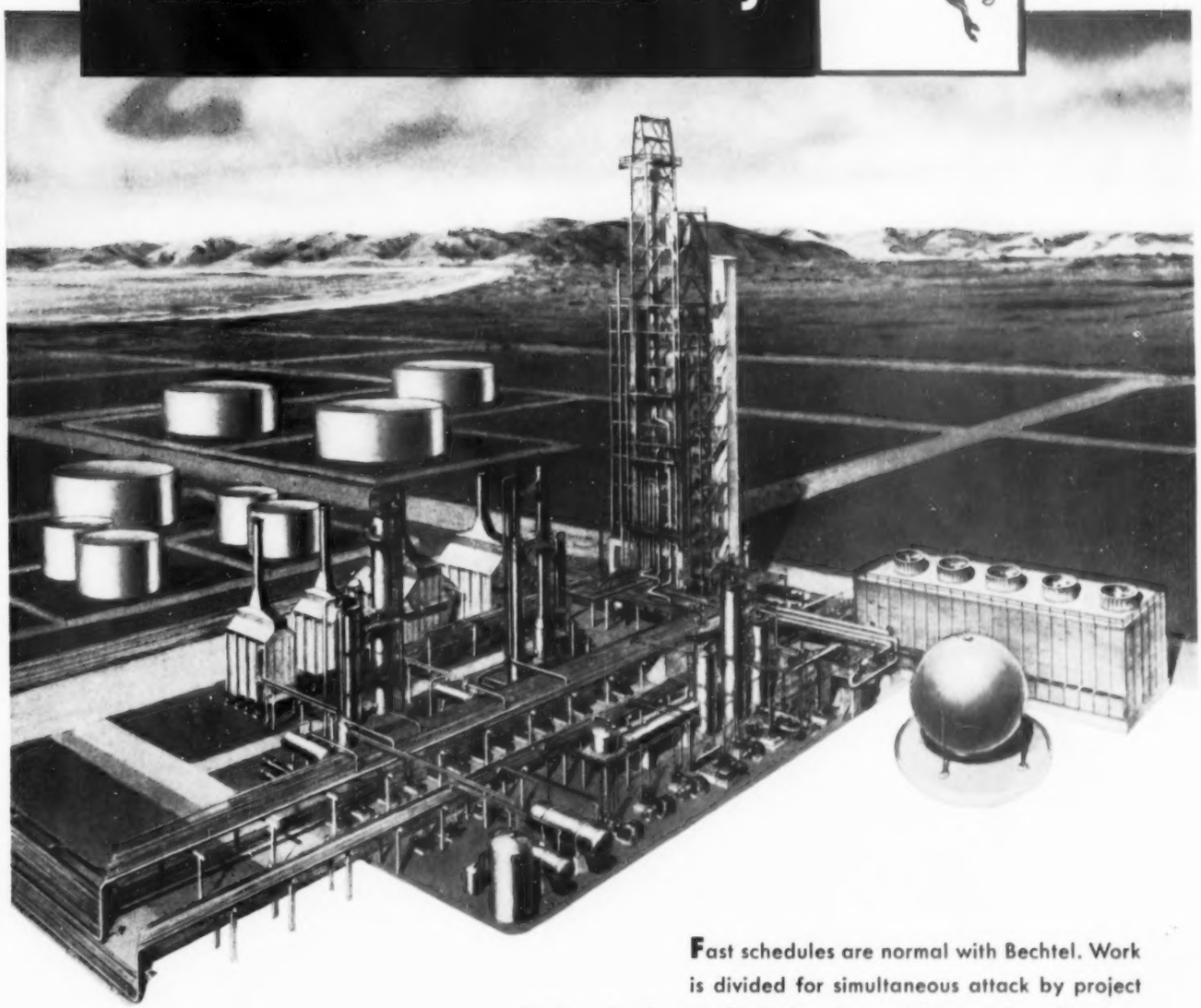
These Valves have no equal for Christmas Tree and Flow Line service and are available in all sizes and for all working pressures normally required by the Oil Industry.

AUTOMATIC LUBRICATION CONDUIT GATE VALVE

Newman, Hender & Co. Ltd

WOODCHESTER GLOS. ENGLAND.

When Time Must Fly



● Another Flying Red Horse "first." A significant development in the field of refining pioneered by Socony-Vacuum Oil Co., Inc., this is only the second Thermofor catalytic reformer to be built. Like the first, for Socony-Vacuum in Kansas, it is a Bechtel job—design, procurement and construction—being built at Torrance for Socony-Vacuum's western affiliate, General Petroleum Corporation. Capacity: 19,000 barrels-per-day.

Fast schedules are normal with Bechtel. Work is divided for simultaneous attack by project teams, closely coordinated under senior executive direction. Each job draws upon the facilities of the entire organization for:

. . . counsel and technical specialties

. . . estimating and cost control

. . . procurement, expediting and inspection (with permanent personnel at many key locations)

. . . supervisory and skilled manpower

. . . recruitment and labor relations

Placing full responsibility with Bechtel is the ideal solution to problems of design, supply and construction.

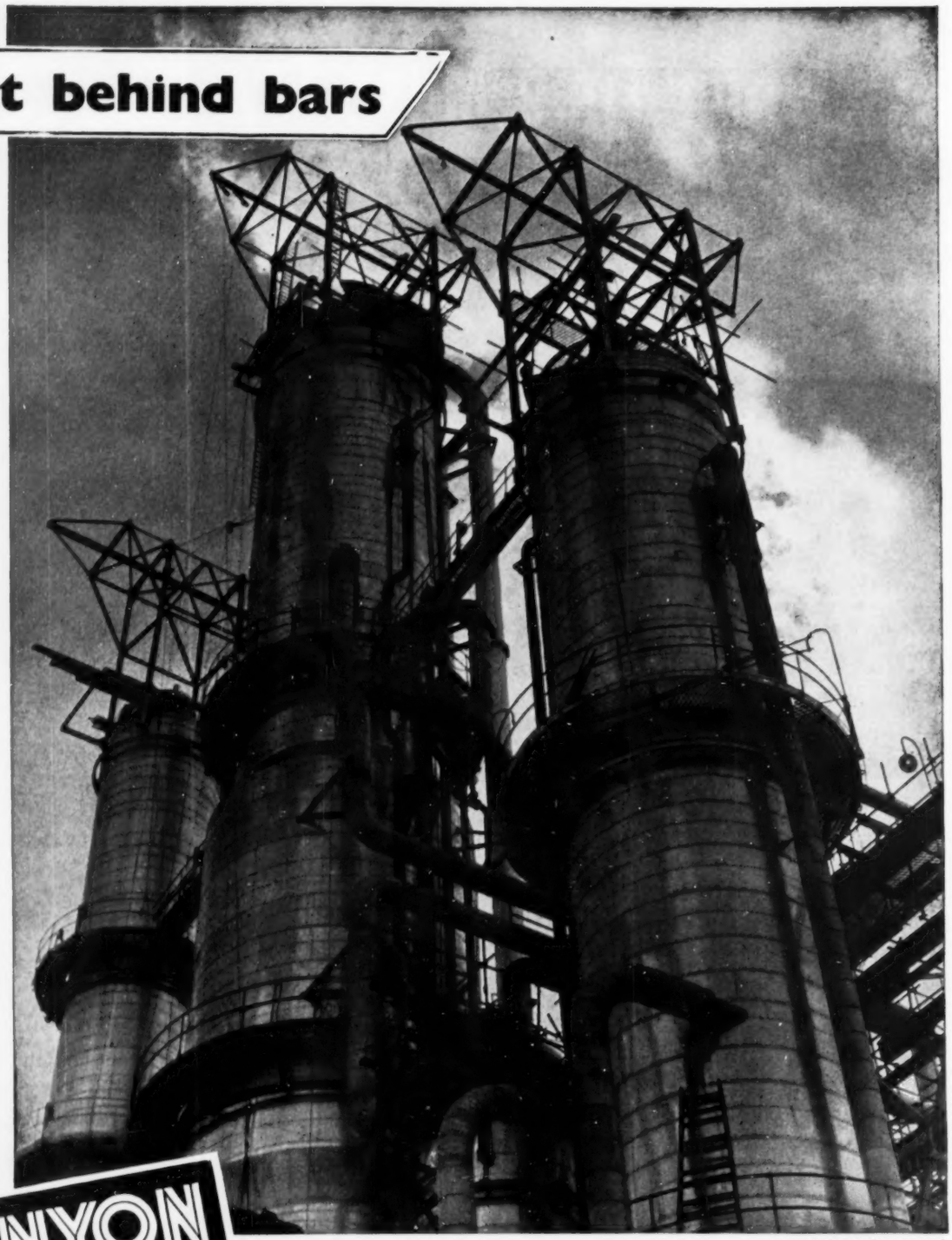
BECHTEL

BECHTEL CORPORATION

BUILDERS FOR INDUSTRY

Los Angeles • **SAN FRANCISCO** • *New York*

Heat behind bars



A Shell Photograph

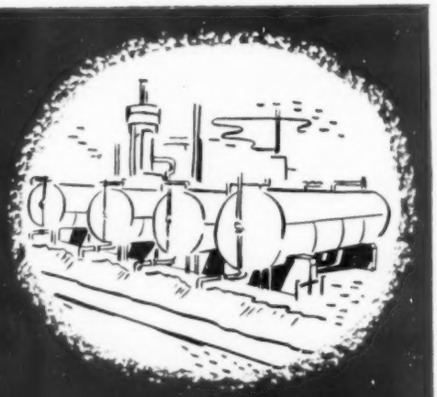
KENYON *Planned* HEAT INSULATION

Kenyon provide a *complete* thermal insulation service to the oil industry, including technical advice on thermal insulation specifications, and finishes for all conditions. Supply of materials, application, supervision, on sites throughout the world. The photograph shows columns on the Distillation Unit, M.E.C. project at Ellesmere Port, Cheshire.

Call in KENYON to keep the heat in!

WM. KENYON & SONS (AMERICA) LTD., PERTH AMBOY, N.J., U.S.A.

WILLIAM KENYON & SONS LTD., DUKINFIELD, CHESHIRE, ENGLAND



STEEL TANKS

All requirements for storage and processing vessels for crude and refined petroleums can be met by our facilities for tank and pressure vessel construction. Welding is carried out to Class 1 and Class 2 requirements and we are on Lloyds recognition list for welding standards.

STRUCTURAL STEELWORK

Through our Associate Organisation, the Cargo Fleet Constructional Department, we undertake the design, fabrication and erection of supporting structures for tank installations and the construction of buildings of all types and sizes for refinery projects in any part of the world.

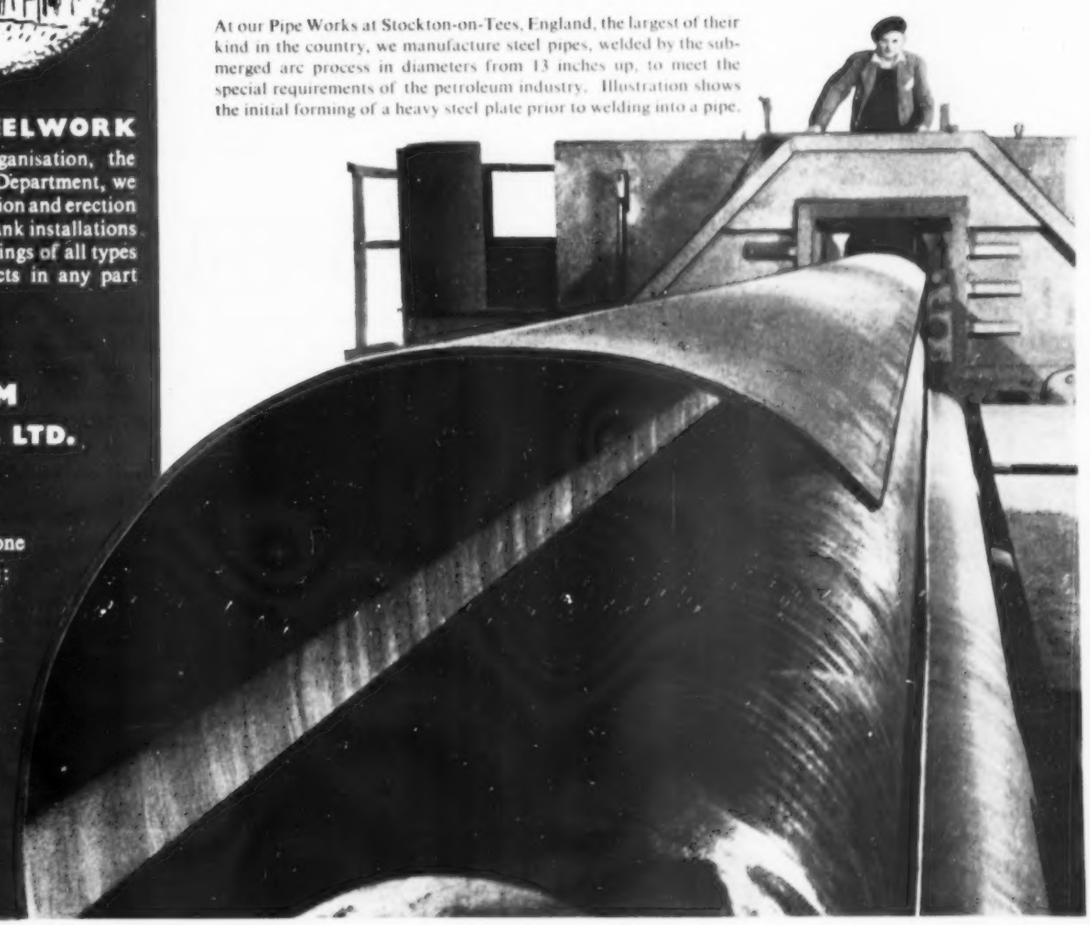
SOUTH DURHAM STEEL & IRON CO. LTD.

Central Selling Office,
Middlesbrough, England.
Telegrams: "Carfleco" Phone Middlesbrough. Telephone: Middlesbrough 2631 (10 lines).
Codes: Lieber's Standard: ABC 5th Edition: Western Union: Bentleys: Lombards.

SOUTH DURHAM

steel pipes for the Petroleum Industry

At our Pipe Works at Stockton-on-Tees, England, the largest of their kind in the country, we manufacture steel pipes, welded by the submerged arc process in diameters from 13 inches up, to meet the special requirements of the petroleum industry. Illustration shows the initial forming of a heavy steel plate prior to welding into a pipe.



Kills Oil & Petrol Fires with SPEED & CERTAINTY

Nicerol is supplied in heavy gauge steel drums designed for quick release and clean pouring.

★ Nicerol can be used in any type of mechanical foam or air foam apparatus. In this case a base injection type in-line inductor is being operated.

★ The secret of Nicerol effectiveness lies in the small bubble formation. It creates a tough, efficient blanket. 3 gallons of Nicerol and 100 gallons of water will produce over 1,100 Imperial gallons of foam.

★ The above gasoline and oil blaze was extinguished in a matter of seconds by a normal mix of Nicerol Foam Compound.

Meet the hazard of fire with Nicerol, the foam compound that kills any oil or gasoline fire quickly and absolutely. Nicerol is a concentrate, producing a heavy type foam of closely-knit small bubbles which form a tough, vapour-tight blanket over the surface of burning oil or gasoline. It is characteristic of Nicerol Foam that it flows with the fire and is highly resistant to flash-back or re-ignition. It can be used successfully in any type of mechanical foam or air-foam apparatus — is equally effective with salt water or fresh and can be stored for years without deterioration.

The Royal Navy and the Royal Air Force use it and so do Oil Companies, Fire Equipment Manufacturers, Civil Air Lines, several Commonwealth and Foreign Government departments, and Fire Brigades throughout the world. What better recommendation?

Manufacturers: **NICEROL LIMITED**
GREAT BRICK KILN STREET
WOLVERHAMPTON, ENGLAND

Representative for U.S.A.
GEORGE T. REYNOLDS
P. O. BOX 395 • THORNWOOD • NEW YORK
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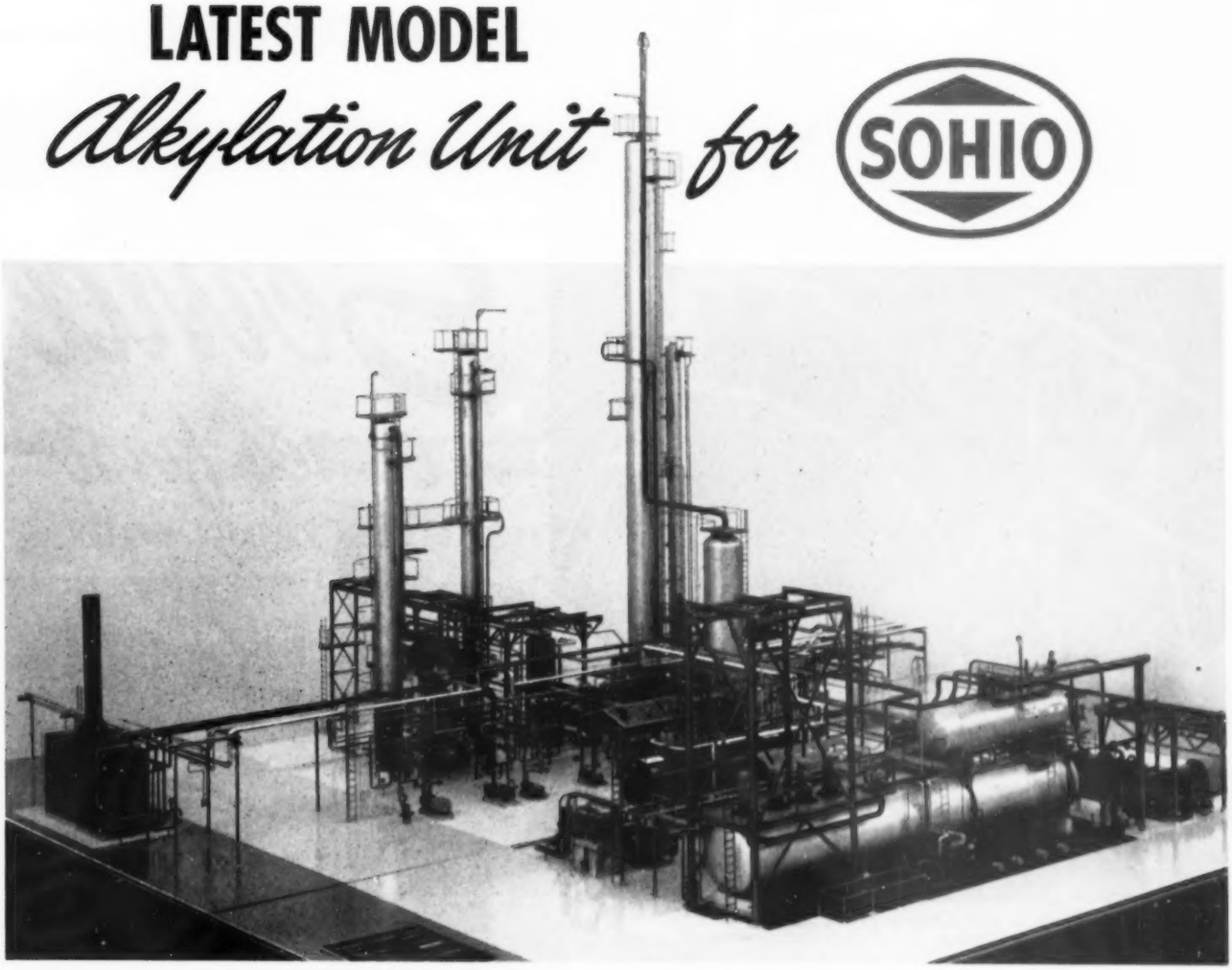
LATEST MODEL *Alkylation Unit* for SOHIO



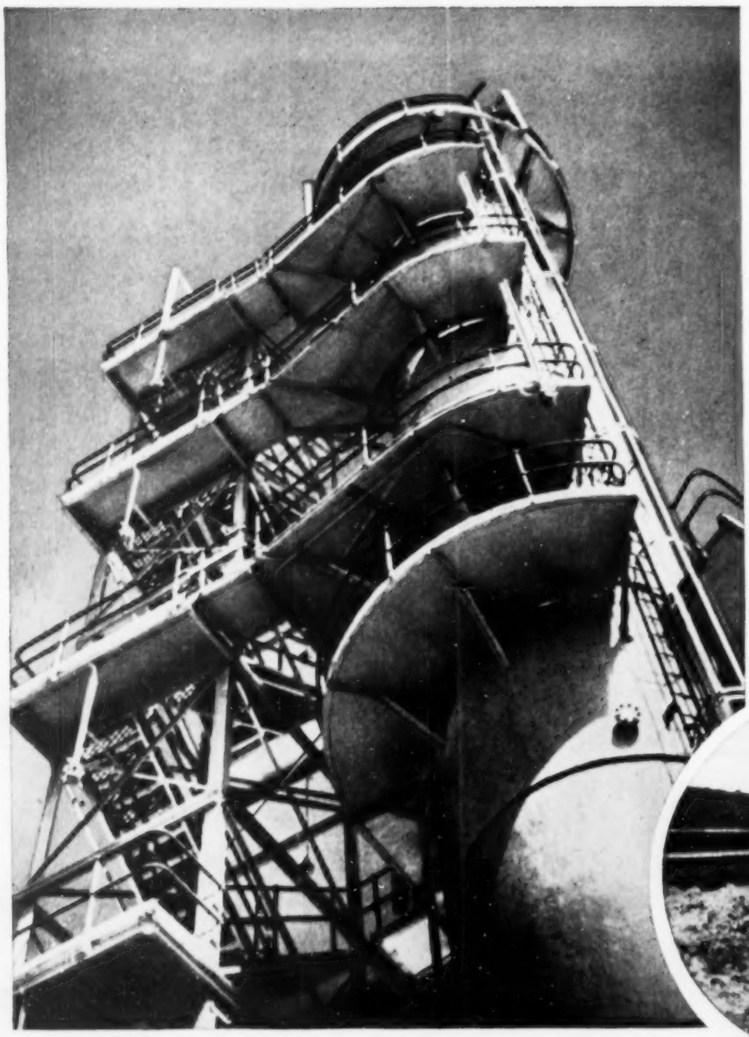
THIS model of an alkylation unit was built from engineering drawings to a scale of ¼ inch to 1 foot. Its purpose is to help check engineering and speed up construction of a new alkylation unit designed and now being constructed by Arthur G. McKee & Company for Standard Oil Company of Ohio at Toledo.

The Sohio project is one of four new alkylation units now in progress by the McKee organization. The others are located at Wood River, Illinois; Norco, Louisiana and Texas City, Texas. Combined capacity of the four units will be approximately 21,000 barrels of alkylate production per stream day.

ENGINEERING, PURCHASING AND CONSTRUCTION FOR THE PETROLEUM REFINING AND IRON AND STEEL INDUSTRIES

Arthur G. McKee & Company • Established 1905

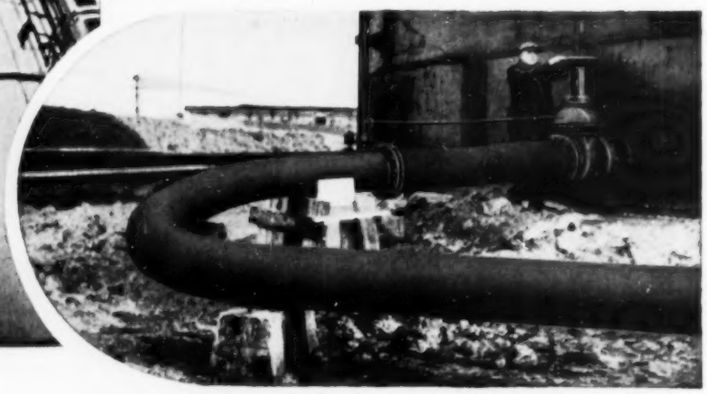
Headquarters: McKee Building, 2300 Chester Avenue, Cleveland 1, Ohio.
Offices: New York • Tulsa, Oklahoma • Union, New Jersey • Washington, D. C.
British representatives of Metals Division: Head, Wrightson & Company, Ltd.
Canada: **Arthur G. McKee & Company of Canada, Ltd., 350 Bay St., Toronto 1, Ont.**



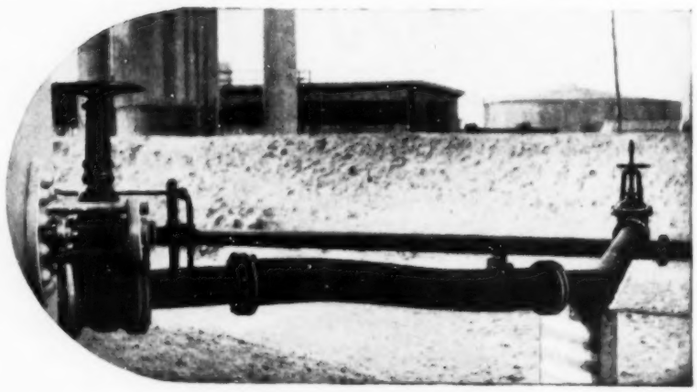
A column of the Reforming Unit at Cardon Refinery (a Shell Photograph)

* ***DUNLOP EQUIPMENT is installed at oilfields and refineries throughout the world.***

Service comes first—



Dunlop Oil Suction and Discharge Hose bridging the gap between pipe line and storage tank. This type incorporates high-quality, hard-wearing, oil resistant synthetic rubber compounds, and is suitable for the severest conditions



In the application of rubber to oil production, Dunlop have long, world-wide experience and this accumulation of practical knowledge is available to you through the Dunlop Technical Service even *before* you specify. You can obtain the skilled advice of this bureau of specialists on every aspect of equipment selection, from the first moment you consider new or replacement materials.

The wide range of Dunlop products developed for the oil industry is listed at the foot of this announcement. If you have a problem affecting this type of equipment, please contact your nearest Dunlop representative or distributor who will provide every assistance. Or, if you prefer, send your enquiry to Dunlop's Manchester address below. Technical Service advice is freely and gladly given, and no obligation is incurred by you

DUNLOP
A WORLD WIDE SERVICE TO THE OIL INDUSTRY

OIL SUCTION & DISCHARGE HOSE, SLUSH PUMP HOSE.
INDUSTRIAL HOSES for a wide range of uses in the Oil Industry such as welding, and pneumatic tool use.
V-BELTS to A.P.I. or B.S.I. Specifications.

FLAT TRANSMISSION BELTING.	***CEMENTING PLUGS.***
VALVE INSERTS.	***PACK-OFF RUBBERS.***
SWAB RUBBERS.	***PISTON RINGS.***

DUNLOP RUBBER CO. LTD. (GENERAL RUBBER GOODS DIVISION), MANCHESTER, ENGLAND
Cables: Rubber, Manchester
Depots and Distributors throughout the World

...dollar per dollar

b.t.u. per b.t.u..... .....

PETROCHEM-ISOFLOW FURNACES

are most efficient by any comparison!

BETTER HEAT DISTRIBUTION

MAXIMUM FUEL EFFICIENCY

LOW PRESSURE DROP

LOW MAINTENANCE

ZERO AIR LEAKAGE

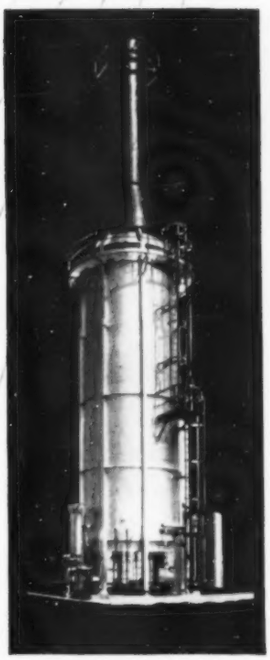
EXPLOSION RESISTANT

MINIMUM GROUND SPACE

SHORT LENGTH OF LIQUID TRAVEL

EXCESS DRAFT FOR HIGH OVERLOAD

PLENUM CHAMBERS FOR HAZARDOUS AREAS

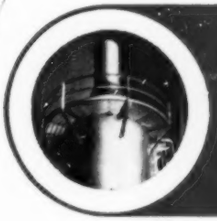


simplicity of design and construction

The Isoflow Heater basically is a circular steel shell; this results in an explosion-resistant structure. The shell is lined on the inside with insulation and insulating refractories; this results in a wall with a zero air leakage and high efficiency. The vertical tubes are combined with integral convection tubes; this results in less headers in the heaters for complete cleanability. The integral radiant convection tubes and minimum number of headers result in a minimum pressure drop for a given velocity. The vertical tubes completely shield the walls resulting in low wall maintenance. The small number of headers in combination with the vertical tubes result in ease of cleaning and, if desirable, gang-cleaning of several tubes simultaneously. Individual burners, symmetrically spaced with relationship to the tubes, results in even heat distribution horizontally. The reradiant cone effects even heat distribution vertically. Segregated burners result in ease of firing and inspection of burners. These are some of the design features which place Isoflow Furnaces in a class of their own

—most efficient by any comparison.

More than 1150 are in operation throughout the world in the petroleum, chemical and allied industries . . . for all processes and for any duty, pressure, temperature and efficiency . . . and all Petrochem-Isoflow Furnaces are pre-eminently satisfactory.



PETROCHEM-ISOFLOW FURNACES

UNLIMITED IN SIZE . . CAPACITY . . DUTY

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Stand and deliver!

The highwayman of the eighteenth and early nineteenth century, much romanticised in fiction, was in reality little more than a thug. His cry of "Stand and deliver!" was dreaded by timorous travellers, as the prelude to ruthless highway robbery. These bandits added yet another peril to travel by stagecoach — a form of transport which already presented hazards enough!

Today's transport has its hazards, too . . . Bandits may be fewer and farther between, but whenever valuable goods must be transported over long journeys, no precautions may be neglected to prevent losses in transit. Not the least of these precautions—perhaps the most important—is safe packaging. Valuable fluids, powders or kindred products need to be packed in foolproof containers that will withstand, without leakage, the hurly-burly of rough handling and long journeys under severe conditions. That is why so many industries rely on Metal Containers for drums. Leakproof, tamperproof drums that keep their contents intact throughout the longest journeys are made in a wide range for many purposes. Metal Containers have solved many packaging problems—may they solve yours?

METAL CONTAINERS

METAL CONTAINERS LTD., 17 WATERLOO PLACE, PALL MALL, LONDON.

M-W.109

THE STEEL TUBE AGE

The major portion of the 500 miles of steel pipe required for the construction of the Coryton refinery has been supplied by S & L direct to site, in sizes ranging from ¼ inch to 43 inches diameter. In addition we carried out in our works the manipulation of some 2,000 tons of process pipework. We also supplied, direct to the refinery, welding fittings to the value of £30,000.

The illustration, based on a Vacuum Oil Company photograph, shows 36 inch S & L steel water-circulating mains, with externally welded steel joints, in course of being laid.

STEWARTS AND LLOYDS LIMITED

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S&L

To function efficiently, our mechanized world looks to its suppliers for ever-increasing amounts of petroleum products which maintain sea, and land transport systems and keep production lines rolling. *Caltex* fuels, oils and lubricants contribute to the prosperity and well-being of free peoples in 67 lands.

CALTEX

CALTEX PETROLEUM PRODUCTS

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it's oil

it's cracked

up to be

GENERAL REFRACTORIES

Wherever you see the towers and the framework of "cat crackers", you'll find refractory products doing the *inside* job. And Grefco is a major supplier of quality refractories to the entire petroleum refining industry.

Such products as Grefco OLIVE HILL fireclay brick and Grefco High-Strength BRIK-CAST have become leading favorites among oil men.

BRIK-CAST is a hydraulic setting fireclay base castable. It can be molded in forms on the job, or precast into any desired shape and placed in service without pre-firing. That means savings in time and labor.

OLIVE HILL fireclay brick is unrivalled in the industry due to its superior fireclay and unique processing. Careful selection of clays, scientific control of every step of manufacture, grain sizing, efficient methods of de-airing, and accurate, controlled burning make it truly superior in refractoriness, density and porosity. OLIVE HILL also offers excellent resistance to carbon disintegration and good resistance to abrasion and ability to carry heavy load.

Throughout the process of petroleum refining, Grefco has the right product to *do* the job.

For a truly *complete refractories service*—call on Grefco!

GENERAL REFRACTORIES COMPANY

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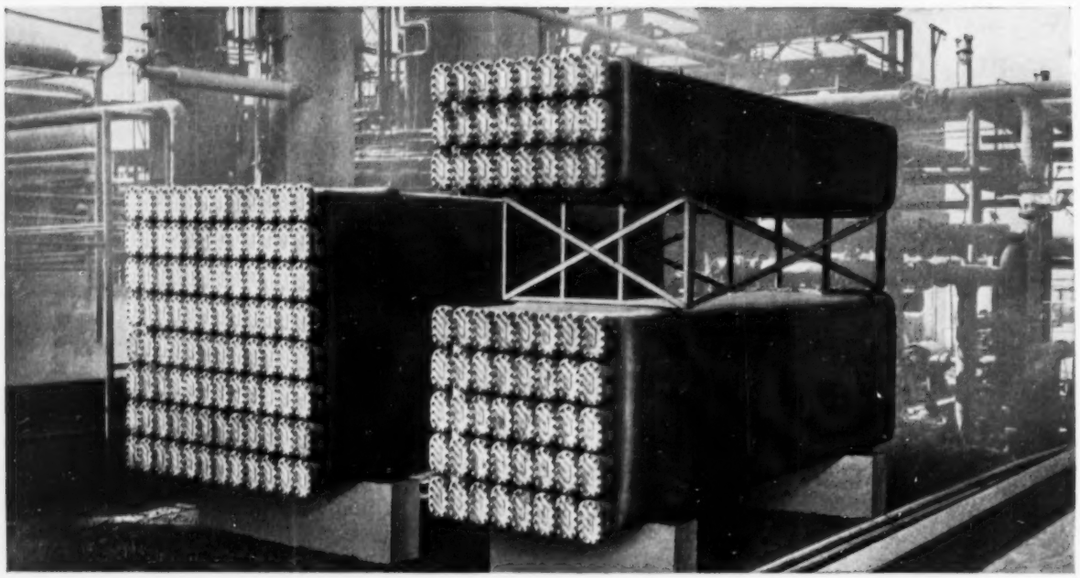
Six Reasons Why

you should specify



BROWN FINTUBE *Sectional* HEAT EXCHANGERS

FLEXIBILITY: If plant requirements change — and this is not uncommon — a "bank" of Brown Fintube heat exchanger sections can be disconnected and reassembled in different series-parallel arrangement easily and on short notice. "Bundle type" exchangers are not flexible. For them a change in duty usually involves designing — and waiting — for a whole new unit.

NO OBSOLESCENCE: Brown Fintube Sections never become obsolete. They can be used in one exchanger after another. Sections not in use serve as "standby" or parts, for other sections on stream.

REDUCED FOULING: Brown Fintube sections transfer more heat per lineal foot at lower surface temperatures. This minimizes coking. Also the longitudinal passages control the material flow eliminating eddies and reducing fouling.

EASY CLEANING: reduces maintenance costs. By manifolding just one extra parallel stream into an exchanger, the entire unit can be operated continuously — always clean — without ever coming off stream.

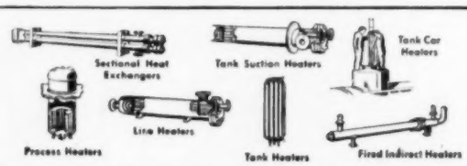
REDUCED STORES: Avoids tying up thousands of dollars in spare parts, housing and handling them.

PROMPT DELIVERY: Standardization permits economical assembly line manufacture from standardized parts — and prompt delivery.

If you heat — or cool — liquids or gases in your plant, you'll get a lot of ideas from our Bulletin No. 512. Send for a copy!

BROWN FINTUBE
HEAT TRANSFER PRODUCTS

BROWN FINTUBE CO.
Elyria, Ohio



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UNITED REFINING COMPANY marks its

50th Anniversary

...with a Blaw-Knox "Catforming" Plant

In line with its 50-year policy of using the latest refining techniques in the manufacture of premium quality products, United has commissioned Blaw-Knox Company, Chemical Plants Division, to design and construct a "Catformer" plant at their Warren, Pennsylvania refinery.

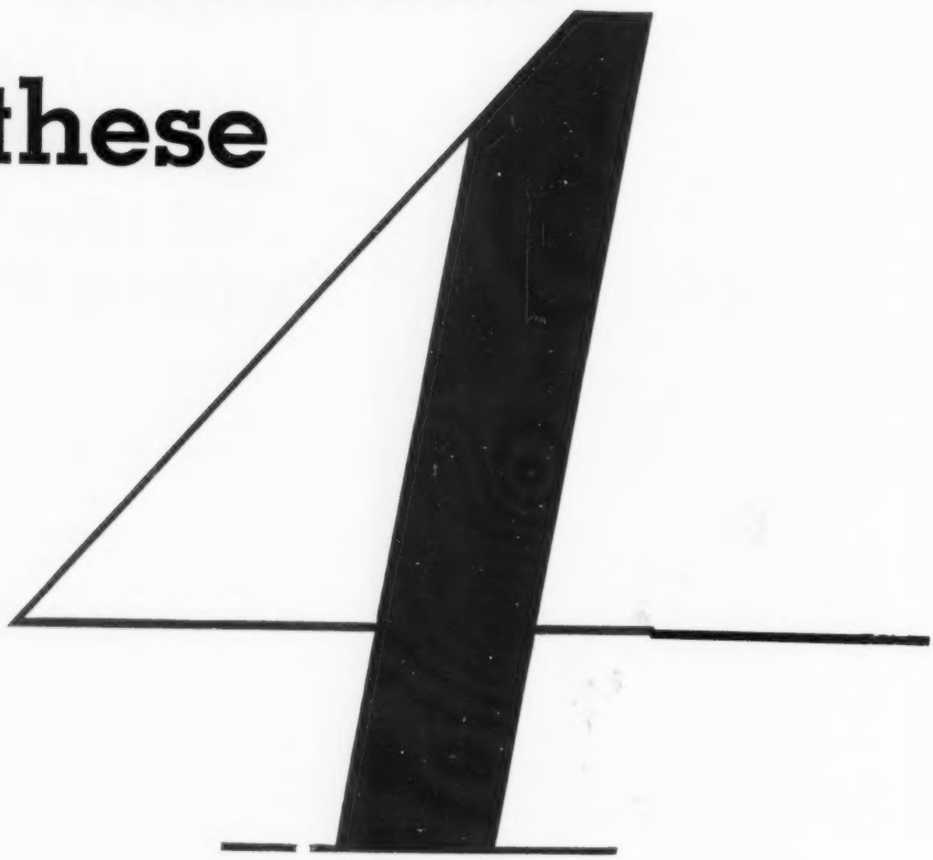
The Atlantic Refining Company "Catforming" process is an economical means for up-grading low grade naphthas to high octane gasoline at 95-100 per cent yield. The catalyst is selective and rugged; the yield-octane relationships are well established by pilot plant evaluation of numerous stocks; and commercial operations have confirmed basic design features.

Chemical Plants Division is licensed to offer Atlantic's "Catforming" process and would be pleased to discuss product yields and qualities, plant investment and operating costs with you. "Catforming" offers an economically attractive solution to your octane problem.

BLAW-KNOX COMPANY
CHEMICAL PLANTS DIVISION
Tulsa 1, Oklahoma
Chicago 1
New York 17
Pittsburgh 22

BLAW-KNOX

Catforming combines these



advantages

The Atlantic Catalytic Reforming Process brings you:

1. high yield

The Atlantic Catforming Process was specially designed to produce high octanes at high yields. It properly balances all the many reactions necessary for the production of high octanes, assuring you of a high yield-octane relationship and maximum liquid recovery of high octane products from any feed stock.

2. low cost

Catforming units can be designed by *your own* contractor, thus providing important economies and greater simplicity. Commercial units of from 750 to 12,000 BPD charge capacity are now being built at investment costs of only $250 to $400 per barrel. In operation, no feed preparation, product finishing or costly regeneration facilities are needed.

3. stability

The catalyst in the Atlantic Catforming Process retains reforming activity for extensive periods, and at the same time has no loss in selectivity. Even under the varied conditions encountered in normal refining operations, catalyst life is from 35 to 100 barrels per pound.

4. ruggedness

Activity and selectivity of the Catforming catalyst are virtually unaffected by water, sulphur compounds, and nitrogen compounds normally encountered in naphtha reforming. Atlantic's catalyst has *proved* its ability to resist physical and chemical change.

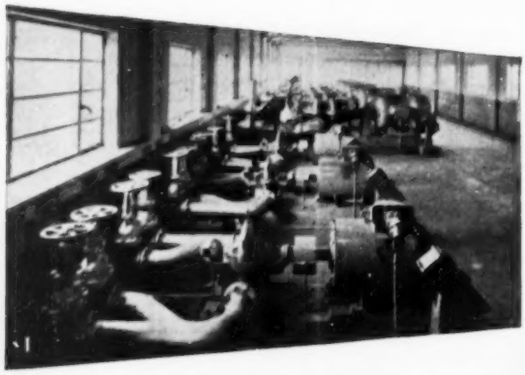
FOR COMPLETE DETAILS call or write The Atlantic Refining Company, Research and Development Dept., P. O. Box 8138, Philadelphia 1, Pa. (Telephone, Howard 5-2345.)

It's the catalyst that counts

ATLANTIC

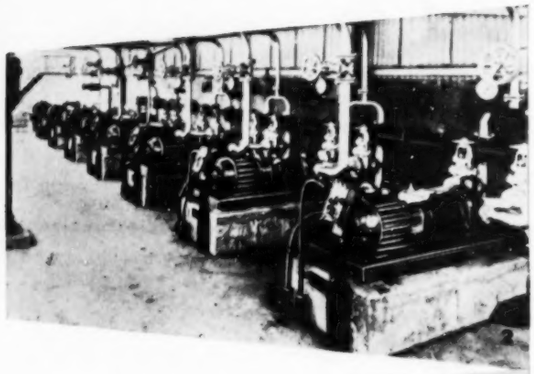
FLAMEPROOF MOTORS

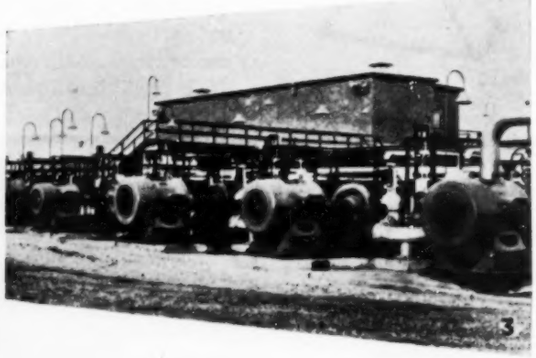
certified for group 2 and group 3 gases

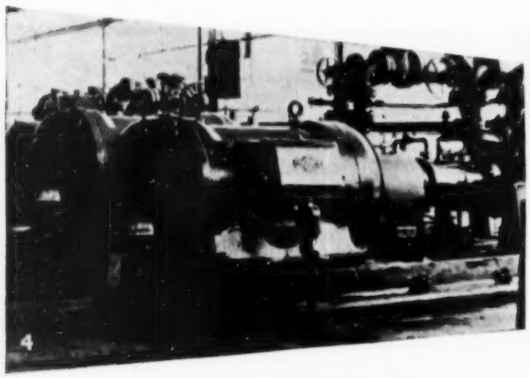


A complete range of Metrovick Buxton-certified flameproof motors is available for refineries and petro-chemical works, for either indoor or outdoor use. Machines with either ball and roller bearings, or sleeve bearings, can be supplied, and all are suitable for hot product pumps.

A specialised range of splash-proof well-pump motors and industrial type machines for non-hazardous locations is also available.







1. A range of flameproof motors in one of the main pumping stations at Scottish Oils, Grangemouth Refinery. 2. Type KFB flameproof motors driving Sigmund pumps at Shell Stanlow Refinery. 3. 300-600 hp outdoor flameproof motors at the product loading station at Esso Refinery, Fawley. 4. 125 hp 3500 rpm T.E.F.C. motors driving oil pumps at Trinidad Leaseholds Pointe-a-Pierre Refinery, British West Indies.

METROPOLITAN-VICKERS ELECTRICAL COMPANY LIMITED
Member of the A.E.I. group of companies
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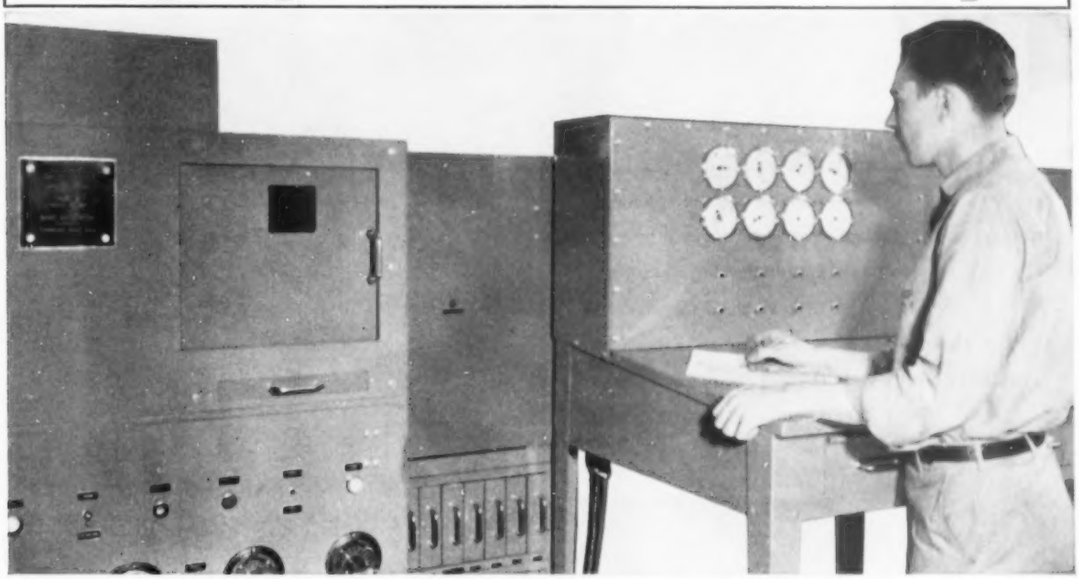
METROVICK *Motors Serve the Oil Industry*

J/M301

Rigidly controlled chemistry



Another reason why you get uniform, high-quality forgings with TIMKEN® forging steels!

YOU can be sure of uniform forgings when you use Timken® forging steels. That's because the quality of Timken forging steels is rigidly controlled, from melt shop all the way through final inspection, by the most precise methods known.

For example, the direct-reading spectrometer shown above chemically analyzes a molten heat of Timken forging steel in just 40 seconds. And a complete analysis report is given to the melt shop within 10 minutes! First of its kind in the steel industry, it's just one of the many ways the Timken Company controls quality at every step in production.

Your order for Timken forging steels is handled individually in our mills. We target conditioning procedure to your particular forging requirements. You can hold rejects to a minimum. And you save steel because the good dimensional tolerances of Timken steel forging bars produce uniform weight multiples with a minimum of steel lost in flashings.

You're assured of uniform physical properties, too, when you use Timken forging steels. They respond uniformly to heat treatment—from bar to bar and heat to heat. Fewer furnace adjustments are needed. And Timken forging steels have uniform grain size after heat treatment. Result: forgings made from Timken forging steels have uniformly high ductility and resistance to impact.

For help in improving the quality of your forgings and cutting production costs, write The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

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Products of Pye scientific research cover ever-widening fields of application. Information gained through experiment on each project is constantly used to develop and improve all allied manufactures. Through advances thus achieved Pye lead the world in quality and design of radio, television and telecommunications equipment.

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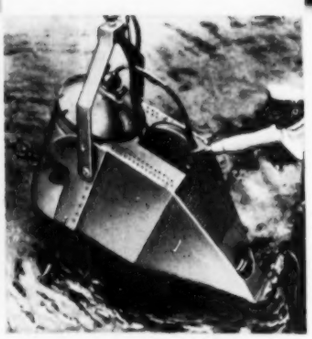
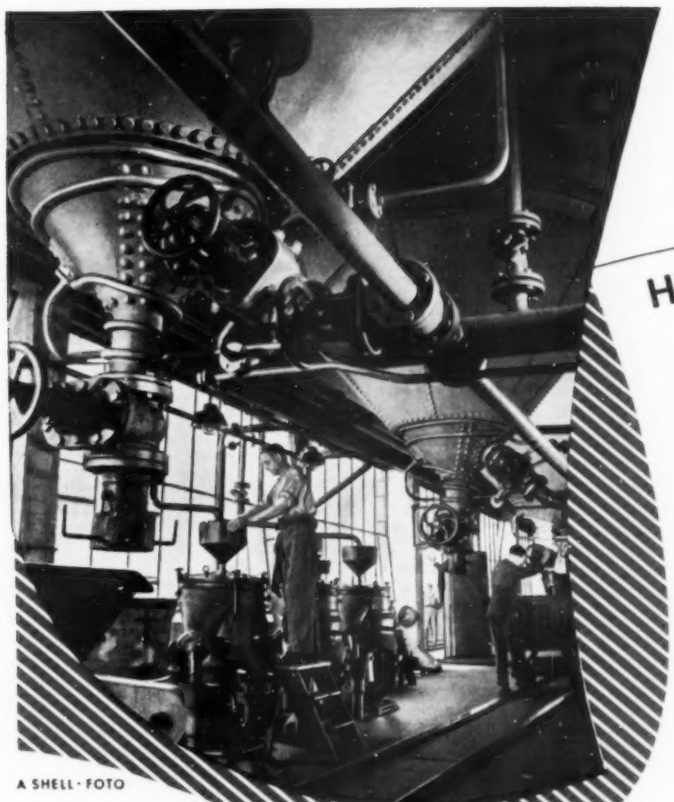


pH METER AND MILLIVOLTMETER

PYE LIMITED CAMBRIDGE · ENGLAND



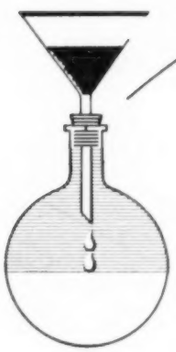
A SHELL · FOTO

HIGH EFFICIENCY

It's no accident that so many important refineries in more than 40 countries of the world depend upon the

Highly Activated Bleaching Earths

TONSIL · TERRANA · CLARIT



Through years of research and experience, and extensive production facilities in most modern plants, we are able to provide our customers with products of high quality and uniformity. We have developed differentiated brands of highly activated bleaching earths for a wide variety of specific needs.

For drilling muds, we are producing the

Activated Bentonite TIXOTON

Please write for literature, samples, and quotations.

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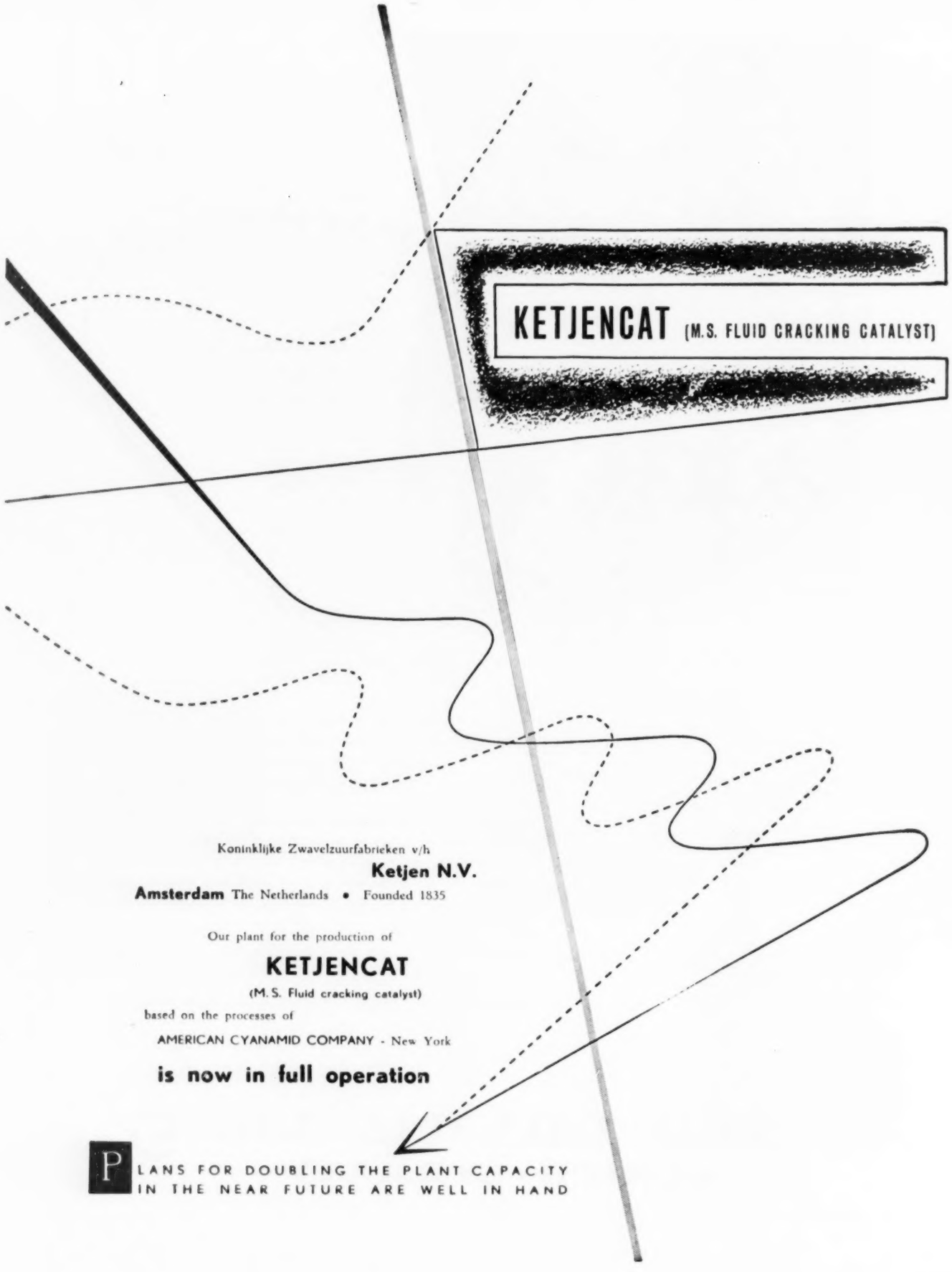
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Our plant for the production of

KETJENCAT

(M.S. Fluid cracking catalyst)

based on the processes of

AMERICAN CYANAMID COMPANY - New York

is now in full operation

PLANS FOR DOUBLING THE PLANT CAPACITY IN THE NEAR FUTURE ARE WELL IN HAND

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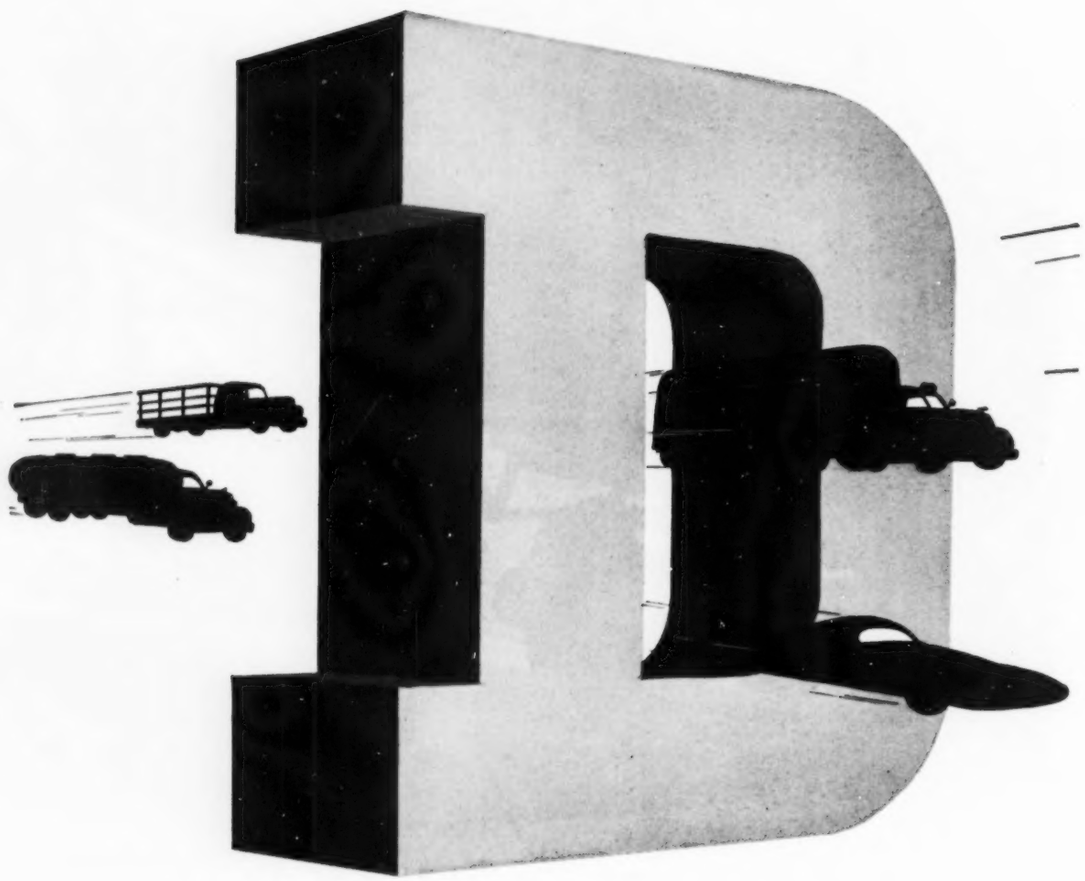
THE UNITED STEEL COMPANIES LTD

This organisation has made a special study of steel requirements of the petroleum industry: plates for fusion welded vessels; constructional steel; forgings; alloy steels, including corrosion and heat-resisting types; etc. The Technical Departments will be pleased to discuss specific applications with manufacturers of petroleum equipment.

THE UNITED STEEL COMPANIES LIMITED OF SHEFFIELD ENGLAND

The Largest Steel Producers in the British Commonwealth

US 56



DAVISON DEPENDABLE CATALYSTS BUILD BETTER MOTOR FUEL

The operating efficiency of synthetic fluid-type cracking catalysts is important. This operating efficiency can be assured by uniformity of physical characteristics and chemical purity. Davison's production of microspheroidal (M-S*) is tops in uniformity . . . providing all users with a highly efficient synthetic fluid-type cracking catalyst. Your requirements can also be supplied in ground (DA-1*) form. Write for further descriptive information. Experienced Davison Field Service Engineers backed up with complete laboratory testing facilities are part of Davison's service.

*T.M.T.D.C.C.

Progress Through Chemistry

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PRODUCERS OF: CATALYSTS, INORGANIC ACIDS, SUPERPHOSPHATES, PHOSPHATE ROCK, SILICA GELS, SILICOFLUORIDES AND FERTILIZERS

PAULSBORO, NEW JERSEY

Fluor played a prominent role in the expansion program now being completed at Socony-Vacuum's Paulsboro refinery, one of the largest on the East Coast. Fluor's "turn-key contract" called for the engineering and erection of the 15,000 B/D Thermofor Cat-Cracker—similar to the one Fluor built for Socony at Augusta, Kansas two years ago—plus the feed preparation system, fractionation units, gasoline plant, piping and many of the offsite facilities—all on schedule and within the budget. Fluor's ability to design, engineer and build complete plants and facilities for the petroleum, gas, chemical, power and heavy industries has been ably demonstrated on many previous occasions.

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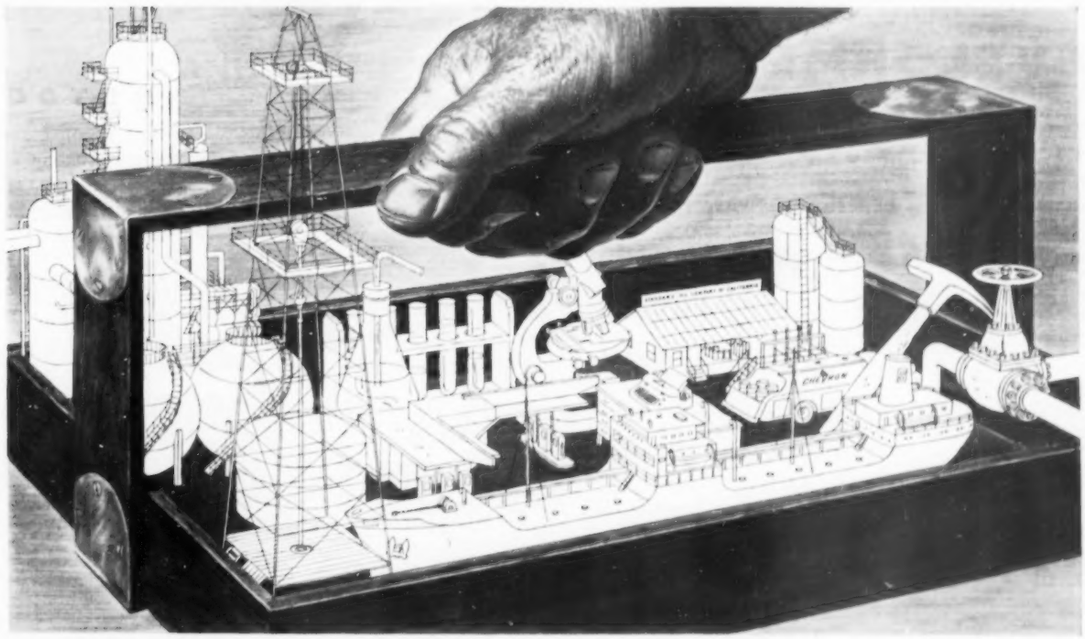
How his $51,000 tool kit works for you

Yesterday—*Manpower* and a drill rig contrived from a springy sapling, cable and drill bits sank our first wells. Since the rudimentary tools restricted their depth, they produced little oil. The "tea kettle" refineries of the day were limited, too. They utilized only a portion of the petroleum and turned out a small number of useful products.



Today—*Each of our 34,750 Standard Oilers works with an average $51,000 worth of tools.* They use diesel-electric drill rigs to tap oil pools as far as three or more miles deep. With refinery units that rearrange the structure of petroleum molecules they make each drop of crude useful. Ingenious production, refining and research "tools" like these enable Standard Oilers to make more than 1100 different products from a barrel of oil . . . gasoline 50% better than it was 25 years ago, and wear-saving lubricants; ingredients for wrinkle-resistant fabrics, low-cost plastics and work-saving detergents; sprays to increase farm crops; asphalt for roads, and many more. Standard's investment in "tools" to make oil serve you better amounts to $1,772,000,000. That's $51,000 worth for every Standard Oiler. With this $51,000 tool kit he not only makes more products—he makes them better, cheaper, more easily available. Questions or comments are always welcome. Write: Standard Oil Company of California, P. O. Box 3495-A, San Francisco, California.

STANDARD OIL COMPANY OF CALIFORNIA ***plans ahead to serve you better***

Matching the machine and the need

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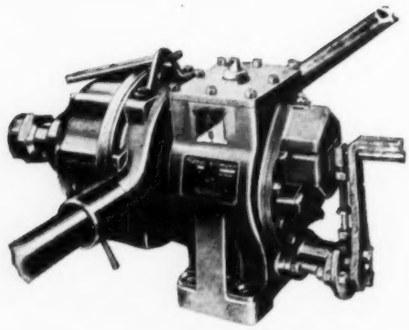
Unceasing research and experiment have enabled Holman Bros. to develop many new and effective applications of compressed-air power to the needs of Industry — particularly the Petroleum Industry Pneumatic Tools made in Camborne, England, can be seen at work in many world-famous refineries, shipyards, railway and motor-car plants, as well as civil engineering enterprises. In nearly every branch of engineering, new needs have brought new and improved Holman Pneumatic Tools.

★ *Full particulars of all Holman Pneumatic Tools gladly sent on request.*



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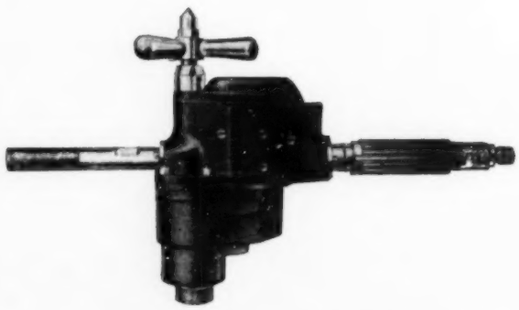
High-efficiency tools specially designed for oil refineries, steam-raising plant, power stations, etc. Powered by vane-type air-motor, and built to endure heavy shock loads. Full range of square chucks.

ROTOGRINDS

New Series—with interchangeable motors. Complete range of precision grinding and heavy-duty tools for internal grinding, cleaning castings, polishing, buffing, scaling, fettling, etc. Simple, efficient, smooth-running, quiet. Straight and grip handles supplied. The range includes **Rotobrushes.**



ROTODRILLS

New Series — with interchangeable motors. Simply constructed, robust and free from vibration. Automatic lubrication. Reversing mechanism gives equal power in either direction, and a stalled drill can be restarted at once.

BROS. LTD.
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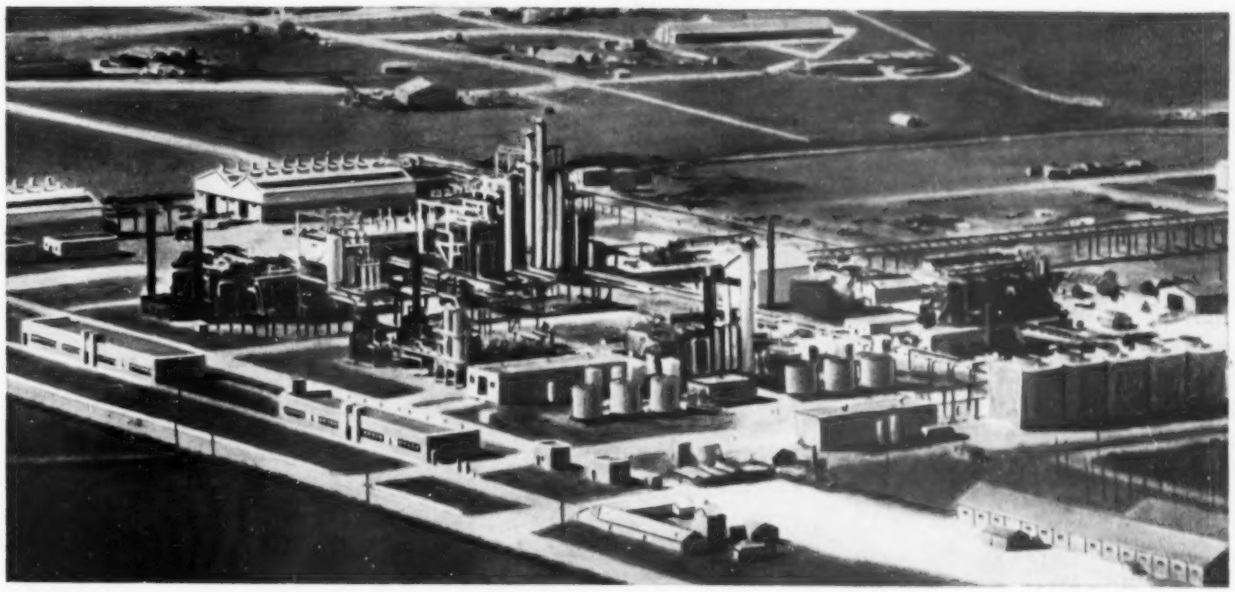
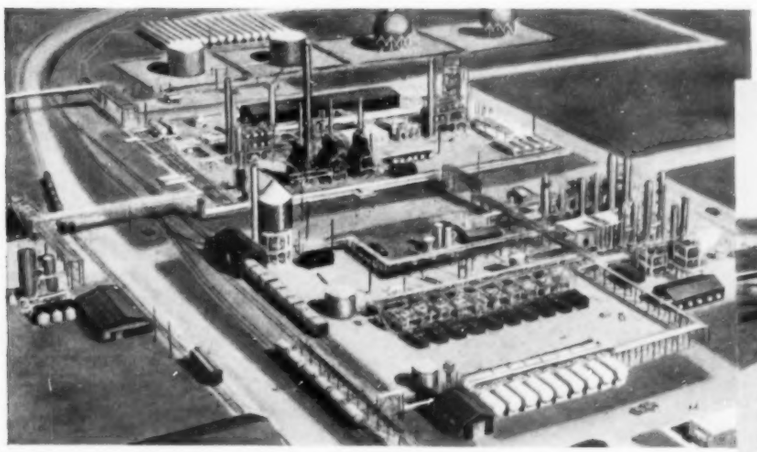


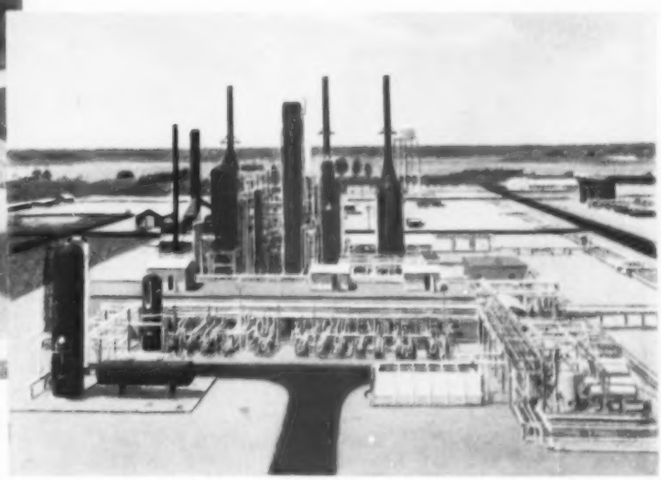
Development Studies *and* Reports

FOR THE NATURAL GAS, PETROLEUM, PETROCHEMICAL AND CHEMICAL INDUSTRIES

Stone & Webster Engineering Corporation, Badger Process Division, has designed and constructed many plants for the process industries to produce intermediate and finished products. Much of this work resulted from development studies and reports made by the Corporation, which included consideration of markets, plant location, raw material supply, processing methods, handling facilities, utilities, transportation and other factors.

The broad experience of the Corporation in the preparation of development and economic studies and reports in these specialized fields is available for new projects.





STONE & WEBSTER ENGINEERING CORPORATION

BADGER PROCESS DIVISION

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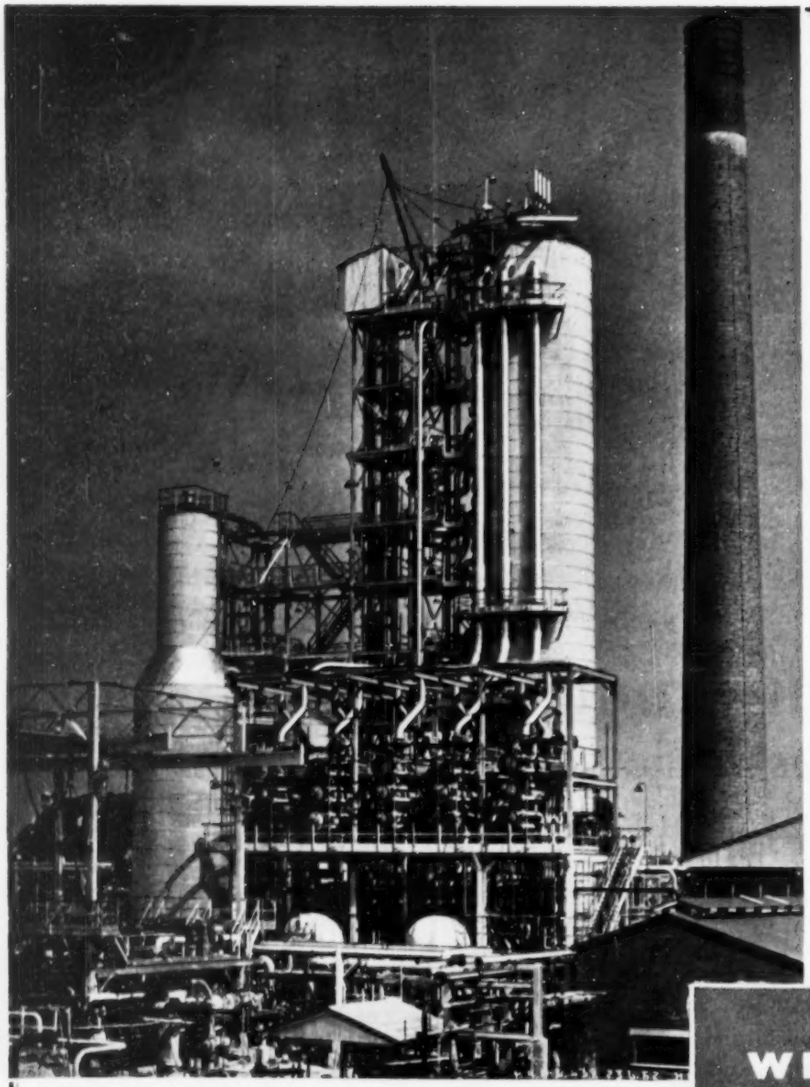

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WIMPEY

OILFIELD DEVELOPMENT

George Wimpey & Co., Limited have carried out contracts embracing all aspects of oilfield development at home and overseas. Our organisation is equipped to carry out any building or civil engineering task of any magnitude, through all its stages, anywhere.

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ELECTRIC DISTILLATE TREATING

The Petreco Electric Distillate Treating Process provides a revolutionary new continuous method for acid, caustic, doctor or otherwise chemically treating petroleum distillates such as naphtha, gasoline, kerosine, diesel fuels and furnace oils. The Petreco Electric Process, compared with the treating processes commonly employed in the past, utilizes less equipment, occupies minimum ground space, requires fewer pumps, less operating attention and eliminates the need for mechanical separating devices. Processing is in a closed system; no fumes or air pollutants can escape. Except for the few pumps required, there are no moving parts. Because the operation is automatically controlled with precision devices, the agent (acid, caustic, doctor) requirements are generally less per barrel of oil treated than those of conventional systems.

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PETRECO DIVISION

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PETRECO

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CRUDE OILS: REMOVAL OF SALTS, SOLIDS, OTHER IMPURITIES; DEHYDRATING

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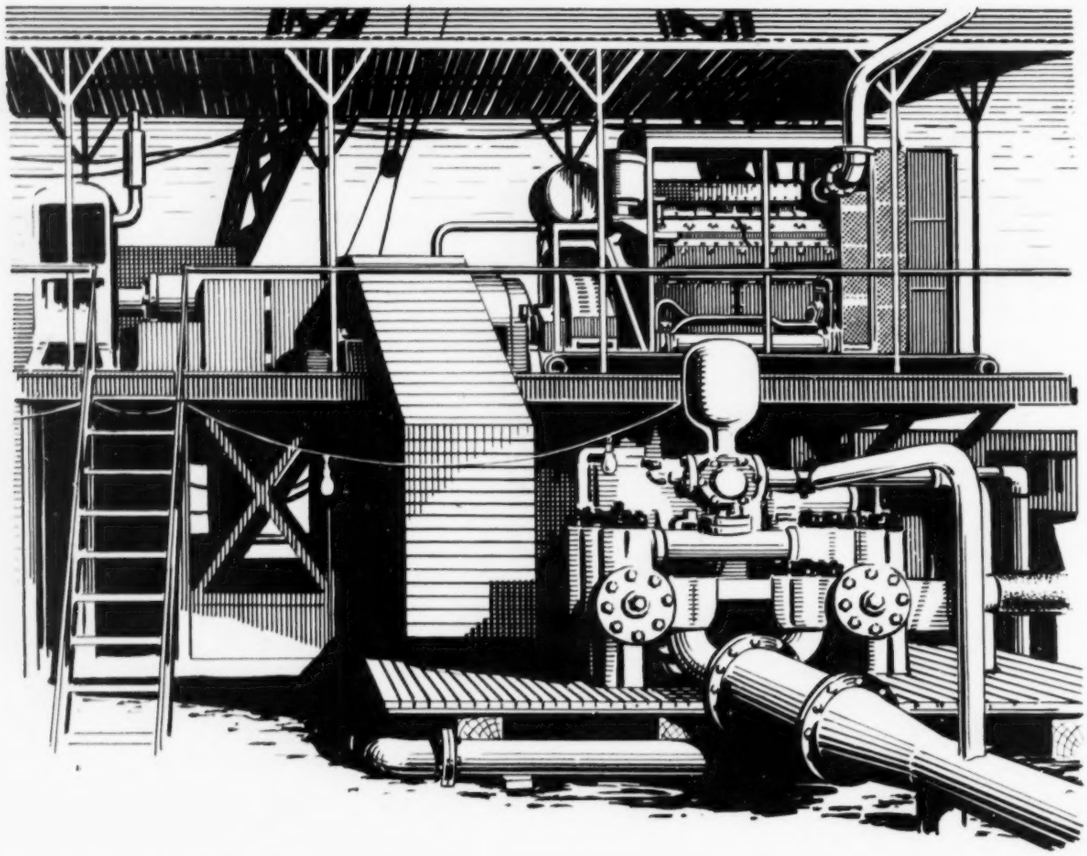
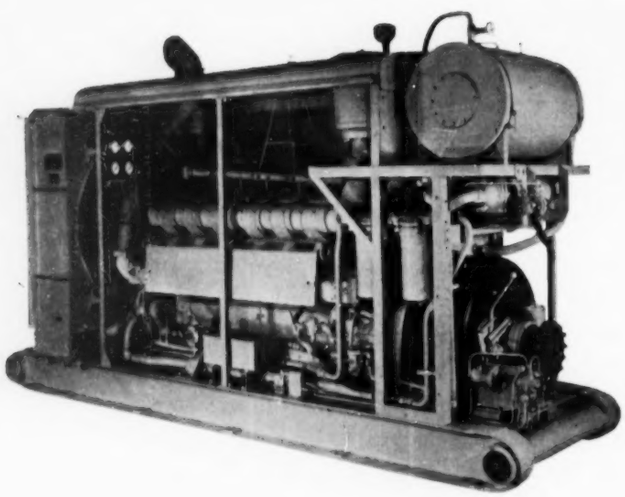


IT TAKES A GOOD ENGINE . . .



. . . to stand up to working conditions in the oilfields. Paxman diesel "Package" sets are chosen for work in oilfields throughout the world, which is a fine tribute to their sterling qualities of design and construction.

- ★ Complete Reliability.
- ★ Continuous Hard Service with minimum attention.
- ★ Easily handled on and off transport.
- ★ Mounted on robust skid-tyre underbase.
- ★ Instant Availability.
- ★ Withstand severe shock.
- ★ Compact and completely self-contained.
- ★ Power Range 130 to 833 B.H.P.

PAXMAN

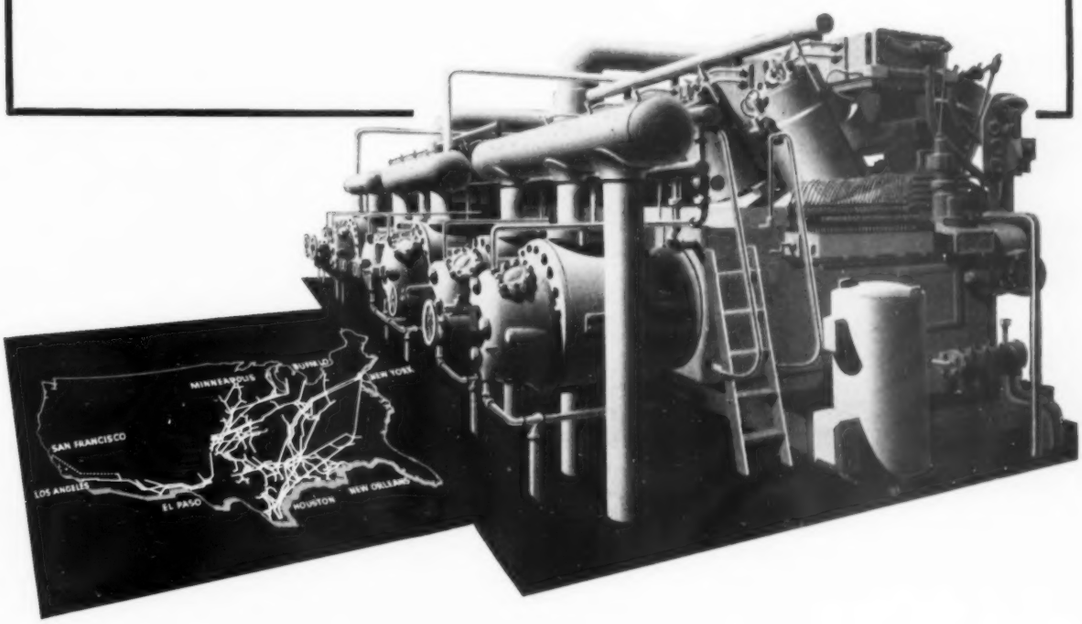
Diesel "Package" sets for oil-well drilling

DAVEY, PAXMAN & CO. LTD. COLCHESTER, ENGLAND

(In Association with Ruston & Hornsby Ltd. Lincoln).

GULF SECURITY OIL

provides better lubrication
for pipe line compressor units,
helps prevent operating troubles



Here's the lubricant you can depend on to help keep your pumping stations operating smoothly and continuously—Gulf Security Oil. It provides effective protection for cylinders and bearings in both engines and compressors.

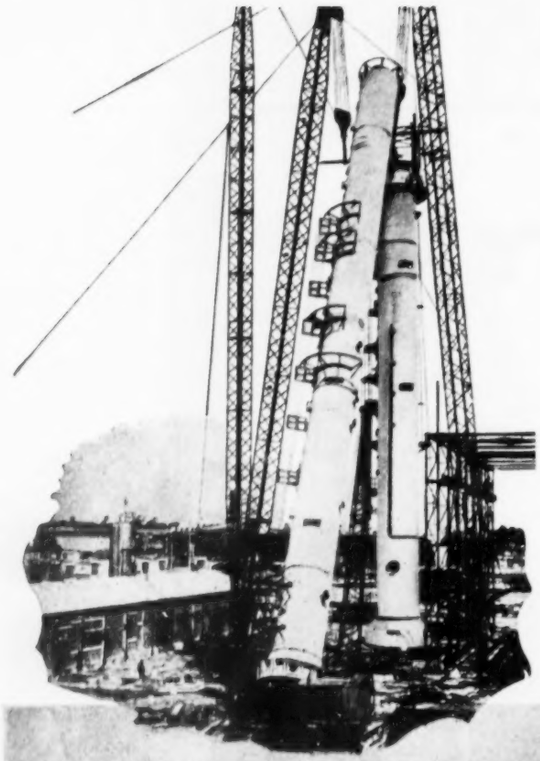
Because of its excellent resistance to oxidation, Gulf Security Oil stands up for many hundreds of hours without any appreciable change in its original properties. After years of operation with this quality lubricant, equipment shows remarkable freedom from cylinder wear and a minimum of carbon deposits on valves and rings. And because oil control rings are kept clean, oil consumption is remarkably low.

Operators of the many units lubricated with Gulf Security Oil report that this quality lubricant helps them get more operating hours between overhauls, and avoid unscheduled shutdowns.

For additional information on Gulf Security Oil and for the services of a Gulf Sales Engineer, get in touch with your nearest Gulf office today. Write, wire, or phone.

Gulf Oil Corporation · Gulf Refining Company,
Pittsburgh 30, Pennsylvania.

GULF INDUSTRIAL LUBRICATION

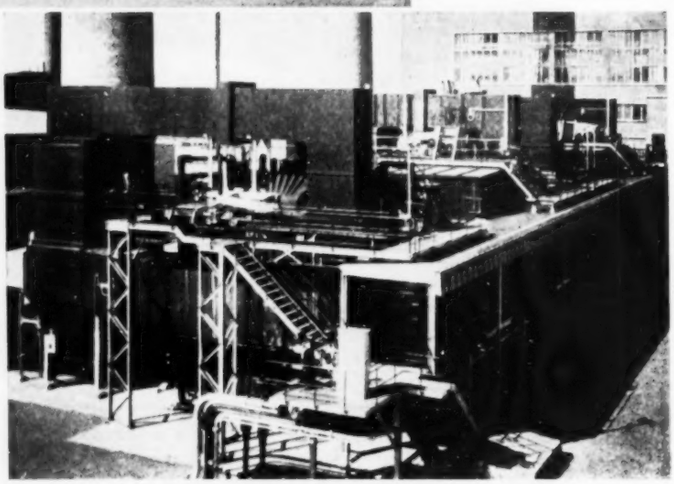


Babcock
Refinery Equipment

Boilers, Welded Pressure Vessels
Heat Exchangers
Waste-Heat Utilization Plant

BABCOCK & WILCOX LTD

are manufacturers of a wide range of plant for the oil industry. Pioneers in the manufacture of fusion-welded pressure vessels, they have made thousands of these up to the largest sizes and for the highest pressures; while in the field of steam raising they bring to each installation an experience of over 75 years and the reputation of the world's leading and largest boilermakers.

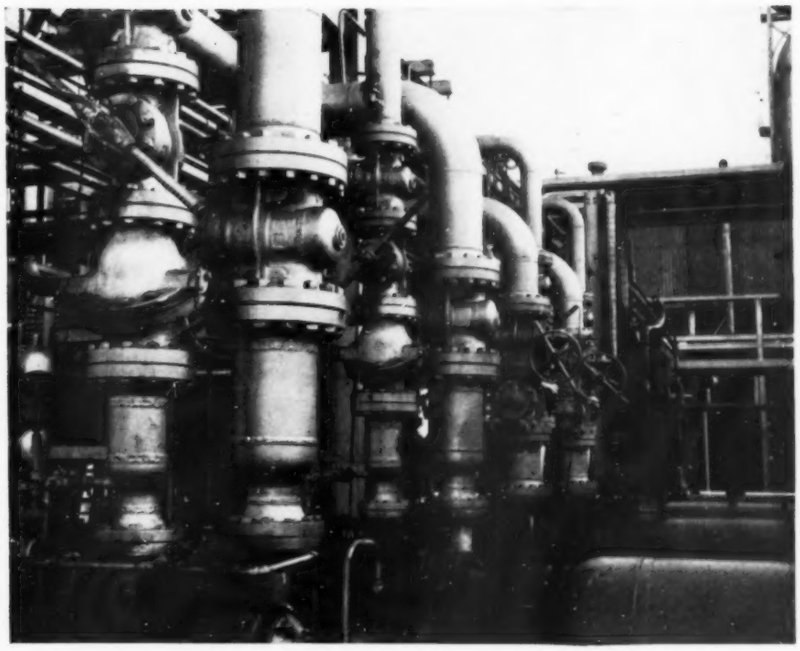


Typical boiler installation, in a European oil refinery, comprising four BABCOCK oil-fired Integral Furnace boilers (each for 75,000 lb. of steam per hour) in a self-contained outdoor arrangement, requiring no boiler house. Above: The illustrations show typical welded treating towers manufactured by Babcock & Wilcox Ltd. for new oil refineries in Great Britain.

BABCOCK & WILCOX LTD., BABCOCK HOUSE, FARRINGDON ST., LONDON, E.C.4, ENGLAND

A Refinery in England.....

A PIPE LINE IN SAUDI—ARABIA



Typical Petroleum Services Using AUDCO-Nordstrom Valves

All over the world, in all types of petroleum services, Audco-Nordstrom valves are gaining greater acceptance as *the* valve to install for positive shut-off.

Audco-Nordstrom valves are sealed by a film of lubricant which prevents leakage, protects seating surfaces, and keeps the valves ready to open or close with a quick quarter-turn.

No matter which petroleum service you're engaged in, there's an Audco-Nordstrom valve designed to suit your requirements. No matter which country your operation is located in, there's an Audco-Nordstrom representative who'll help you specify the valves you need.

AUDCO and Nordstrom

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AUDLEY ENGINEERING COMPANY, LTD.

Newport, Shropshire,

England

OVERSEAS AGENTS located in South Africa, Australia, India, Trinidad, British West Africa, Finland, Norway, Sweden, France, Belgium, Switzerland, Italy, Spain and Portugal.

AMERICAN

ROCKWELL MANUFACTURING COMPANY

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IN DIRTY, DUSTY WORKING CONDITIONS

All moving machinery requires the protection of VOKES filters

In the blinding desert dust storms which sweep the area of the Iraq pipelines, VOKES filters have twice been chosen for the important task of protecting pumping stations and ancillary equipment . . . proof indeed of the important part which VOKES filtration is playing throughout the world in safeguarding plant and machinery from wear, breakdown and unnecessary depreciation. In 30 years nothing has been found to improve upon the basic principles of VOKES filtration for such testing applications as these . . . and the fact that VOKES filter elements are *cleanable* avoids the possibility of the filter being put out of service in remote areas through element replacements not being available. Literature giving details of VOKES filters for all applications in industry will gladly be supplied on request.

ENGINE FILTRATION

VOKES filters for engine protection including lubricating oil filters—filtering all the oil all the time; fuel filters, protecting engines and injection equipment from damage through foreign matter in the fuel supply; engine air-intake filters which prevent the ingress of all particle sizes which would otherwise cause needless damage and depreciation.

ATMOSPHERIC AIR FILTRATION

VOKES filters for air conditioning include the Microvee Dry Fabric Panel Type Air Filter for ordinary atmospheric conditions, and the famous K.600 Kompak air filter, particularly recommended where oily or sooty atmospheric conditions are encountered. These filters can be serviced with the utmost speed and simplicity.

VOKES LTD Head Office: **GUILDFORD SURREY**

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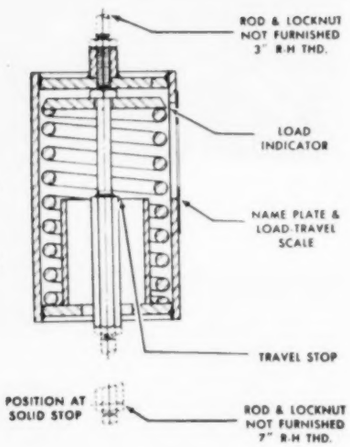
V 76

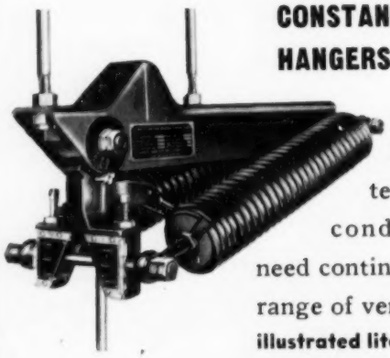
PIPING THAT MOVES CALLS FOR SUPPORTS THAT ARE FLEXIBLE

Vokes "Genspring" Support Hangers give reliable pipe support to meet all conditions of stress and weight-transference. Savings in cost, as against spring hangers designed by the user, are considerable.

VARIABLE SUPPORT HANGERS

for pipe-lines subject to limited vertical movement, can be fitted almost anywhere. If released owing to alterations, load scale data and individual adjustment allow correct re-installation on new piping.


ROD & LOCKNUT NOT FURNISHED 3" R.H THD.
LOAD INDICATOR
NAME PLATE & LOAD-TRAVEL SCALE
TRAVEL STOP
POSITION AT SOLID STOP
ROD & LOCKNUT NOT FURNISHED 7" R.H THD.



CONSTANT SUPPORT HANGERS

are designed for pipe-lines subject to high temperatures, and for all conditions where pipe-lines need continuous support over a wide range of vertical movement. **Write for illustrated literature on Vokes "Genspring" Constant and Variable Support Hangers.**

VOKES "GENSPRING"

SUPPORT HANGERS

VOKES GENSPRING LIMITED, GUILDFORD, SURREY

Department G.B.

Juggling the world's smallest components—atoms and elements—demands the services of some of the world's largest, strongest and most complicated equipment. The petroleum, petrochemical, chemical and atomic energy industries have marched forward in seven-league boots because gigantic plants like Sun Ship have been able to make the "boots." . . . They have kept pace with the engineering needs of the industries . . . have been able to place in the scientist's hands the "tools" which enable him to mold elements as old as the world into products as new as today.

There has been what might be called a chemistry of progress at work in Sun Ship's mighty plant to match the progress of chemistry. The services of its great shops, the skills of its thousands of workers, have been adapted like atoms into new patterns which enable the great plant to make and fabricate the array of equipment . . . the engines and machinery . . . pressure vessels . . . fractionating towers . . . stills . . . tanks . . . catalytic cracking cases and other equipment which serve modern chemistry in building a greater America.

Sun

SHIPBUILDING & DRY DOCK COMPANY

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ON THE DELAWARE • CHESTER, PA.

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REFINERY CONSTRUCTION

GREAT BRITAIN **CANADA**

This photograph of the Anglo-Iranian Oil Company's Kent Refinery under construction indicates the scope of the main civil engineering and building construction contract entrusted to McAlpines who executed the work at a peak rate of £10,000,000 per year.

McAlpines, with their fund of experience of all types of construction, are in a position to advise on all aspects of Refinery construction.

SIR ROBERT

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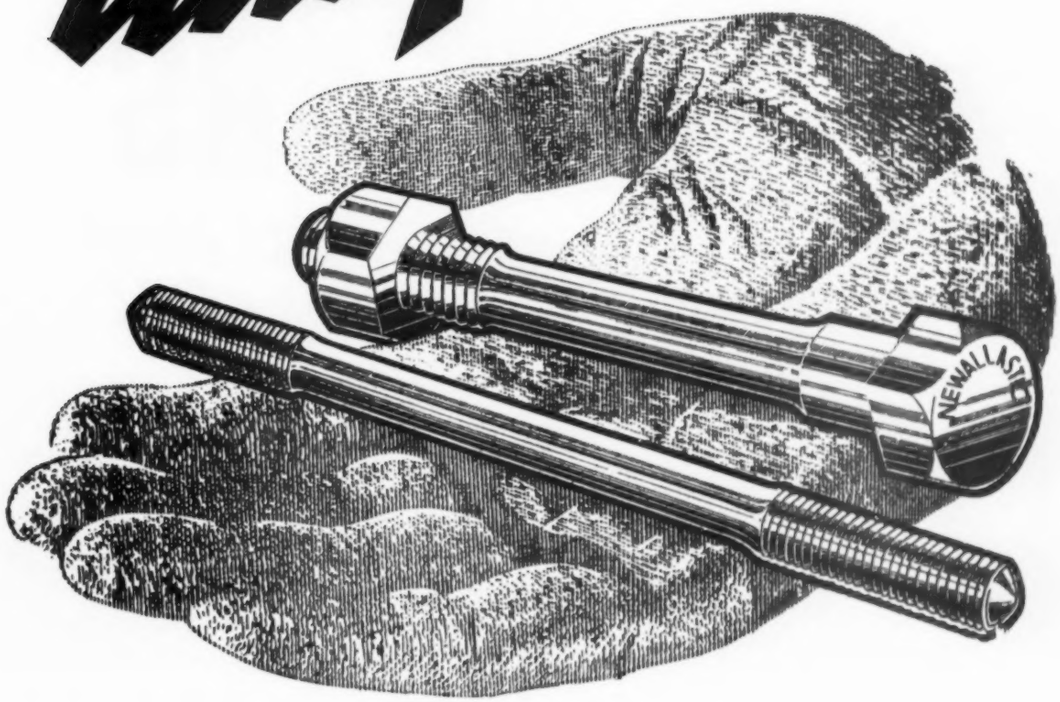
Unique



"Newallastic" bolts and studs have qualities which are absolutely unique. They have been tested by every known device, and have been proved to be stronger and more resistant to fatigue than bolts or studs made by the usual method.

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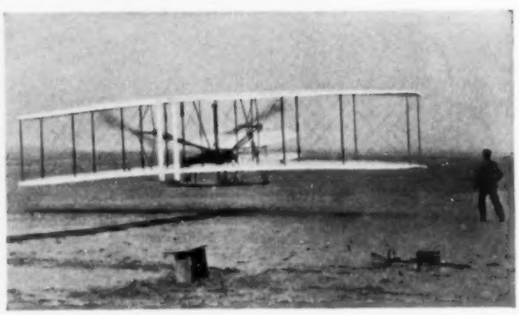
POSSILPARK GLASGOW · N

FOR 50 YEARS

The Greatest Name in Motor Oil!

Before 1903 motor oils used in cars had been developed for other purposes. Then came *Mobiloil*—first *successful* motor oil specifically developed for cars—and the auto industry was on its way!



It was at Kitty Hawk in 1903 that the Wright brothers made the first successful plane flight. On this occasion, and on other pioneering flights, they chose *Mobiloil* for top engine protection!

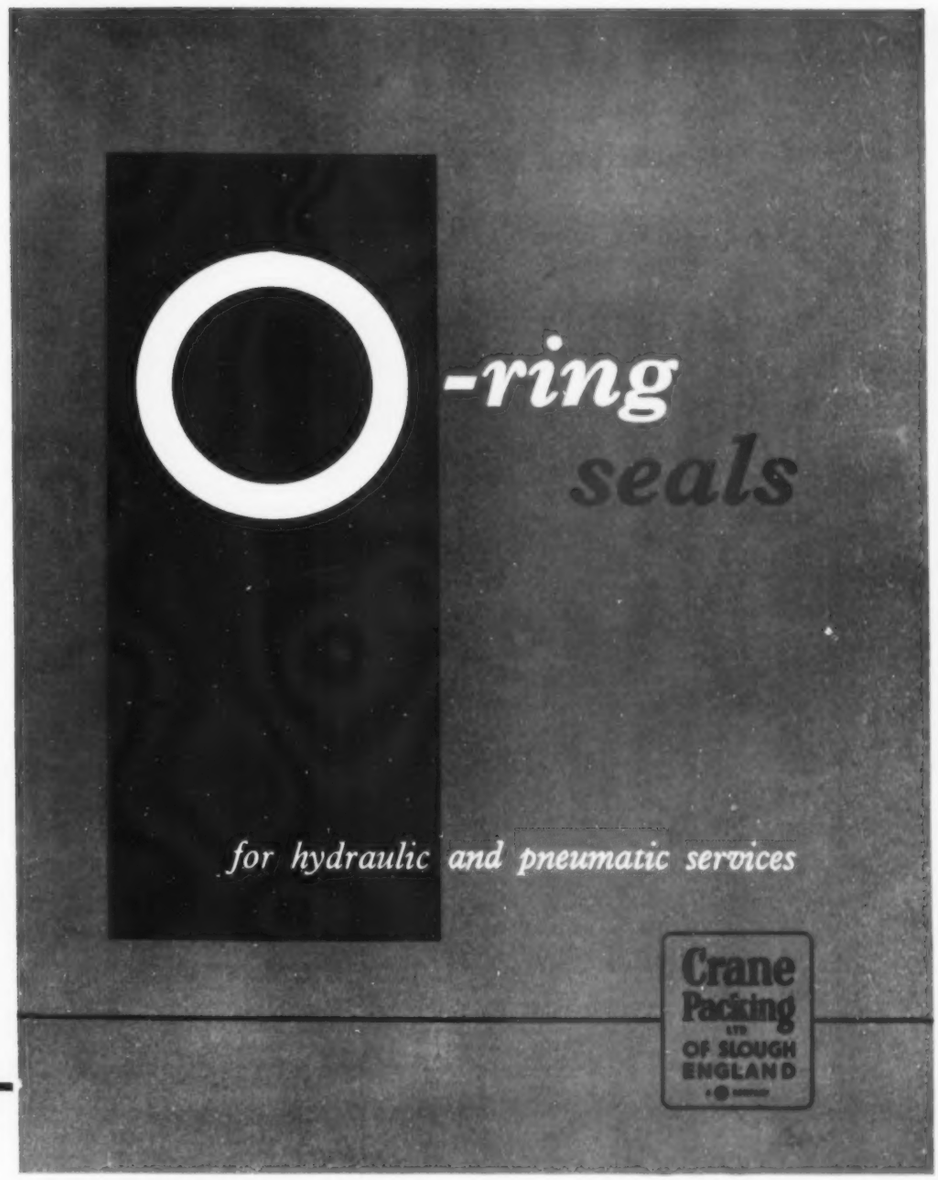
Today's car builders generally recommend a *heavy-duty* motor oil. New super-detergent *Mobiloil* more than meets this requirement—cuts engine wear, helps give longer engine life, better economy!

Today's sky-clippers set new safety records with oils made by the makers of Mobiloil!

1903 · 1953 50TH ANNIVERSARY

Why Sell Anything Less?

SOCONY-VACUUM OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP.



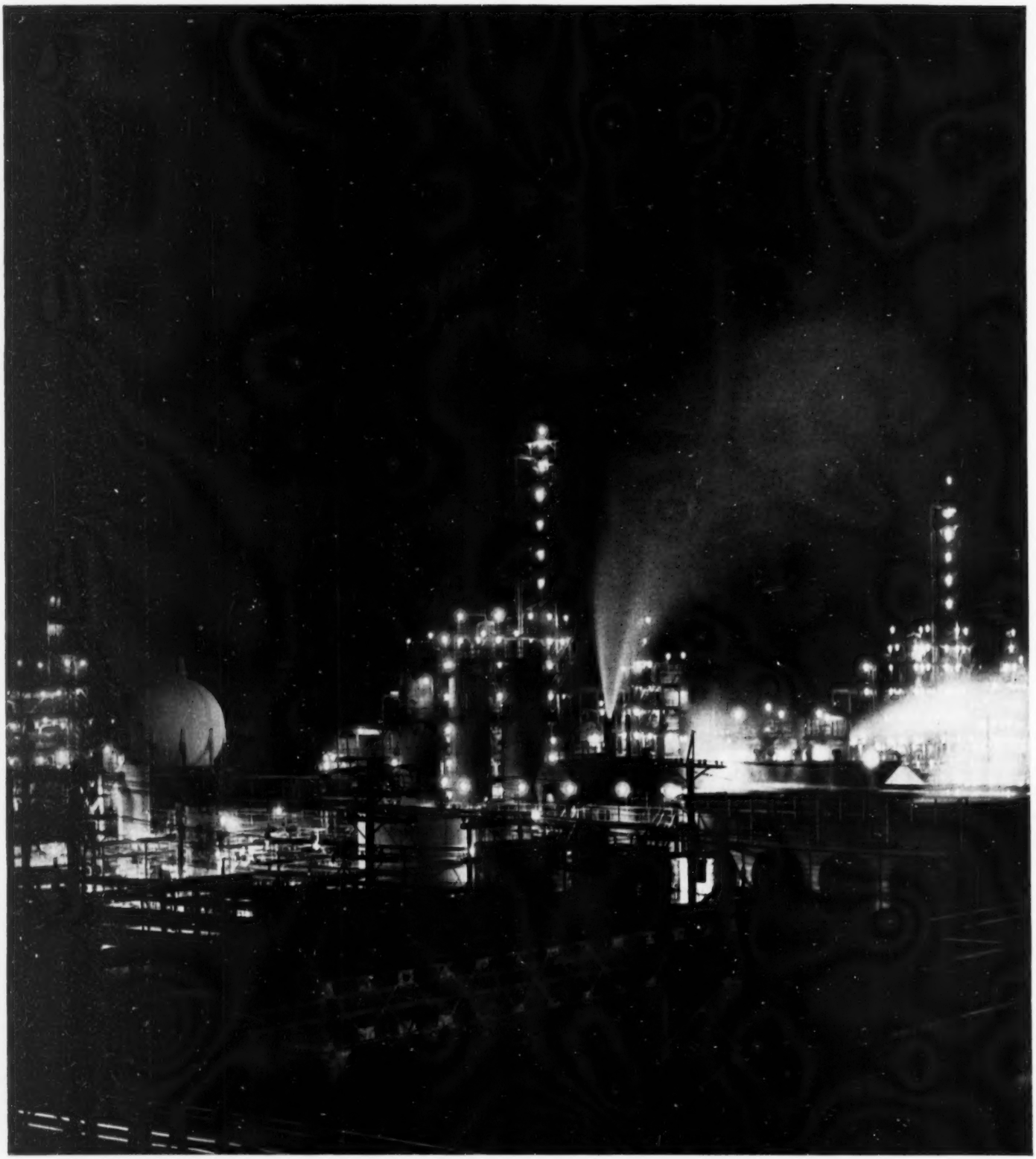
An Authoritative Booklet on O-Rings

For some time we have been manufacturing O-Rings for innumerable applications using various materials according to the requirements imposed by the service conditions.

Now, having **proved** the product in service and having successfully developed methods of manufacturing in quantity without loss of quality or reliability we have published an authoritative booklet on the subject of O-Rings which should be of interest to all engineers and designers who are interested in the use of them.

A copy or copies of this booklet can be supplied at once to any interested firm or individual. Please send your name and address and, in the case of a Company, please let us know for whose attention it should be addressed.

CRANE PACKING LIMITED, SLOUGH, ENGLAND



"New developments in the science of refining make possible better products. This fact, coupled with improvements in consuming devices, means that we can get more work from a barrel of oil today than we could previously. We've only begun to use the energy potential in a barrel of oil."

STANDARD OIL COMPANY
(NEW JERSEY)
AND AFFILIATED COMPANIES

DU PONT

PETROLEUM CHEMICALS DIVISION NEWS

DU PONT

July ★ One of a Series of Interest to the Petroleum Industry ★ 1953

Next Du Pont Gasoline Survey To Be Mailed On July 24

Results of the latest Du Pont Quarterly Motor Gasoline Survey will be mailed to refiners on Friday, July 24.

These surveys furnish current data on octane numbers and TEL content of motor fuels marketed throughout the United States.

Refiners have found the Du Pont Gasoline Survey to be valuable for indicating trends and competitive standings. And there are many who also use it as an aid to their marketing programs.

When the customer says

It's RARELY the fault of the gasoline!

The above headline and cartoon have been reproduced directly from a folder recently put out by Du Pont. Its purpose is to prompt your dealers on how to cope with a common—but often hard-to-answer—customer complaint.

"How many miles to the gallon?" is a familiar measure of both engine and fuel performance. Yet, ever since the gasoline engine first came into popular use, this method of measurement has been frequently misunderstood and misinterpreted. As a result, the gasoline dealer and the oil company he represents are often maligned.

In most cases where a customer complains to a gasoline dealer about poor mileage, improper car maintenance or erratic driving habits rather than gasoline quality are to blame. But service station men are sometimes hard put to explain this to the customer's satisfaction.

The new Du Pont folder makes it easier for your dealers to answer the complaint by serving as a constant reminder of all the mechanical and human factors that contribute to poor gasoline mileage . . . such as dirty spark plugs, a plugged muffler, or accelerator pumping. It quickly pinpoints these factors in concise, easy-to-understand language. There are no long, involved explanations. Simple line cartoons make many of the points graphically clear.

This new folder, "*When the customer says 'poor mileage,'*" is an appropriate sequel to a previous Du Pont folder, "*When the customer says 'knock.'*" The "knock" folder has been extremely popular among oil companies and dealers who have, to date, requested more than 200,000 copies of it.

For sample copies and information on how to obtain the "poor mileage" folders for your dealers, write to any of the Du Pont Petroleum Chemicals Division district offices.

Du Pont Engineering Services Help Refiners Achieve More Efficient Blending Plant Design and Operation

The use and safe handling of tetraethyl lead are highly specialized operations which frequently give rise to some rather knotty refinery problems.

To help refiners solve these problems economically and efficiently, the Du Pont Petroleum Chemicals Division offers special engineering services in blending plant design, construction and operation. This assistance covers every phase of the subject from site selection to training of blending plant personnel.

TO HELP YOU set up efficient TEL blending plant operations, Du Pont will supply you with complete construction drawings and detailed specifications.

After years of study and experience, Du Pont engineers have been able to set up standardized recommendations for plant design and operating procedures. Large refineries generally find these useful supplements to the work of their own engineering departments.

To the small refinery, these recommendations are often extremely valuable as a basis for setting up the entire blending operation.

Since the plant designs are drawn to standard specifications, they may not always solve a particular problem. Therefore, Du Pont is prepared to offer advisory help in tailoring standard designs to fit individual circumstances.

SELECTING THE SITE

Railroad, pipeline and storage facilities, as well as the relative position of refinery units, all have a bearing on the location you choose for a blending

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

DU PONT

PETROLEUM CHEMICALS DIVISION
NEWS

DU PONT

CONTINUED *Engineering Services*

plant. Soil conditions, local code requirements and availability of materials must also be considered. Based on a wide variety of experience in dealing with these factors, the Du Pont engineering service men are prepared to help pick a blending plant site most advantageous to you.

PLANT DESIGN

Complete construction plans for TEL blending plants are available to all refiners. When necessary, Du Pont engineers will be glad to discuss special designs to meet unusual requirements. For example, Du Pont recently helped a large user design a special piling arrangement to support a blending plant on swampy land.

Today, many of the larger refineries are setting up facilities for continuous component blending of refinery stocks, tetraethyl lead, dyes, antioxidants and other additives. If you are considering such a plant, our engineering service men can assist your own engineers on the design.

Even after the actual construction has started, a Du Pont representative is available for consultation. And he will be glad to visit the job to discuss progress with your contractor whenever needed.

PERSONNEL TRAINING

To insure the health and safety of blending plant personnel, a specialized training program is required. Du Pont representatives are prepared to provide complete, detailed recommendations for safe and efficient operation of the blending unit and to assist with the actual training of operators. Also, a member of the Du Pont medical staff will explain the health hazards involved and outline the precautions which should be observed.

DU PONT REPRESENTATIVE (right) demonstrating proper use of tank cleaning safety equipment to refinery personnel.

EASTERN DISTRICT MANAGER

ALFRED R. MULLIS is manager of the Du Pont Petroleum Chemicals Division Eastern District. His first association with the petroleum industry began in the Smackover Oil Fields at the age of 10. His first refinery experience was at a large Gulf Coast refinery during the summer months, while attending college.

In 1938 he graduated from Rice Institute, and received a B.S. degree in chemical engineering. Following graduation, he was employed in the Research and Development Department of the Humble Oil and Refining Company.

During World War II, Mr. Mullis spent four years in the Navy and was attached to the Bureau of Ships as a Petroleum Inspector. In 1946 he resumed his association with the Humble Oil Company in the Petroleum Inspection Department.

Mr. Mullis joined the Du Pont Company in 1947 as a sales-service representative for the Petroleum Chemicals Division. He was assigned to the Gulf Coast District and became manager of this district in 1950. In 1952 he was transferred to New York City to his present position as eastern district manager.

Three Important Considerations Relating To Du Pont Fuel Oil Additive No. 2

1. Have you been receiving customer complaints regarding plugged filters or other stoppage of fuel oil systems due to sediment formed in the fuel? To prevent these conditions, Du Pont Fuel Oil Additive No. 2 not only retards the formation of insoluble residues, but also reduces the particle size of the residues that are formed. The cost of this treatment is only 1.6¢ per barrel, or less.

2. If you are now marketing only a straight-run fuel oil, the use of Fuel Oil Additive No. 2 will enable you to blend your present product with catalytic-cracked stocks of the proper boiling range without fear of causing clogged fuel systems. Marketing the blend will permit you greater flexibility to meet peak seasonal demands, increased yield of domestic heating oil and release of straight-run stocks for sale as premium diesel fuel or for use as charging stock.

3. If you are presently using a fuel oil additive, the chances are you can obtain the same end results, or even better performance, at lower cost with Fuel Oil Additive No. 2. And, from the standpoint of freight costs, the high active ingredient content of Du Pont Fuel Oil Additive No. 2 is a further advantage.

Samples for testing in your own stocks as well as a booklet describing the properties, applications and performance of Fuel Oil Additive No. 2 are ready for you. Ask any Du Pont Petroleum Chemicals Division representative or address your request to one of the district offices listed below.

DU PONT

Better Things for Better Living
. . . through Chemistry

Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Petroleum Chemicals Division • Wilmington 98, Delaware

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A-5638

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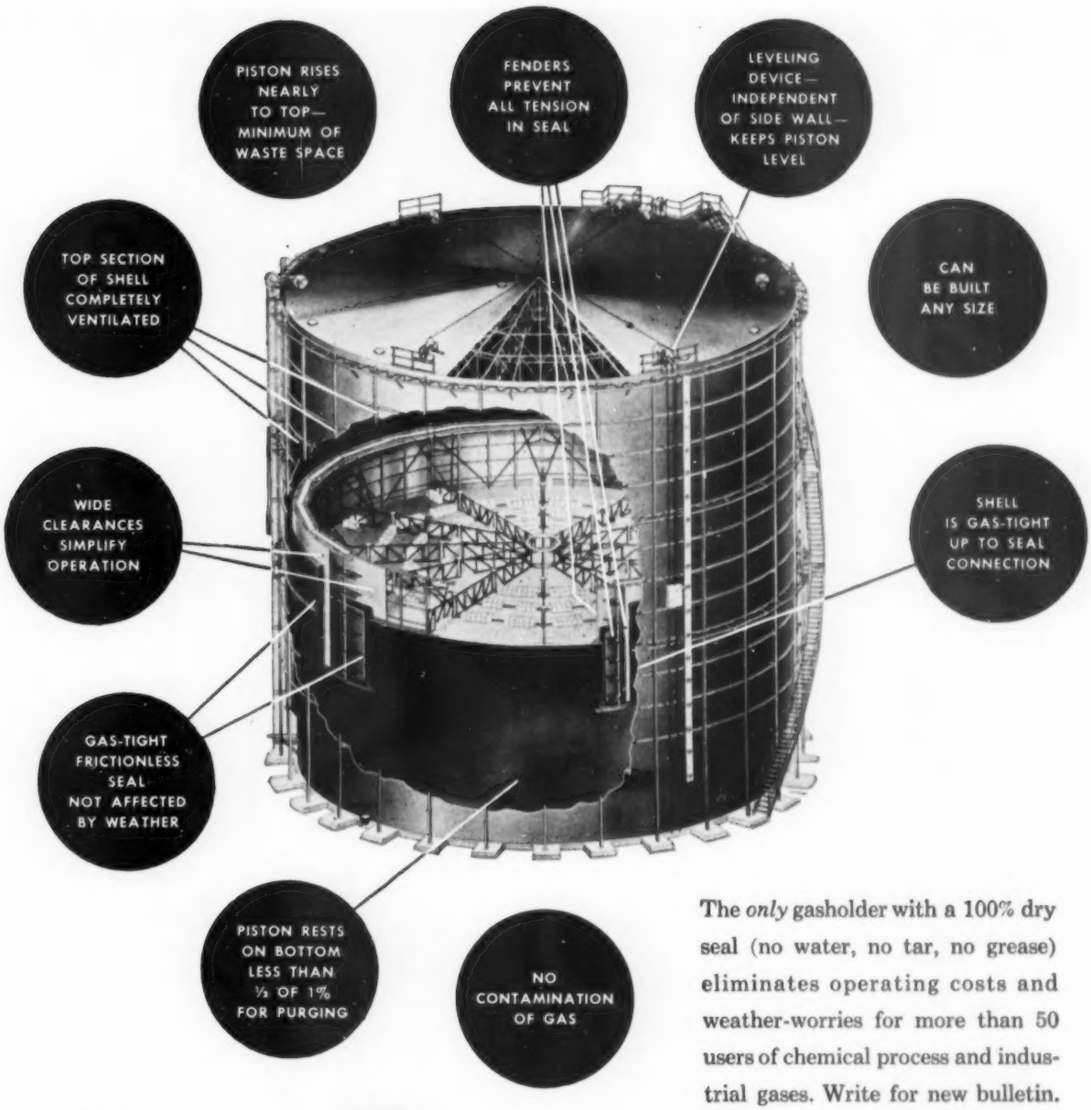
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TOP SECTION OF SHELL COMPLETELY VENTILATED
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GAS-TIGHT FRICTIONLESS SEAL NOT AFFECTED BY WEATHER
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The *only* gasholder with a 100% dry seal (no water, no tar, no grease) eliminates operating costs and weather-worries for more than 50 users of chemical process and industrial gases. Write for new bulletin.

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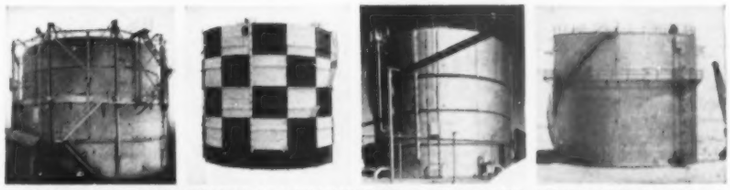
Your old gasholder can be converted to a Wiggins type with all the Wiggins advantages.



EXPORT DIVISION GENERAL AMERICAN

GENERAL AMERICAN TRANSPORTATION CORPORATION

Export Division: 10 E. 49th Street, New York 17, New York

REPRESENTATIVES AND LICENSEES THROUGHOUT THE WORLD

Write to Export Division for full information and for the name of your nearest Representative.

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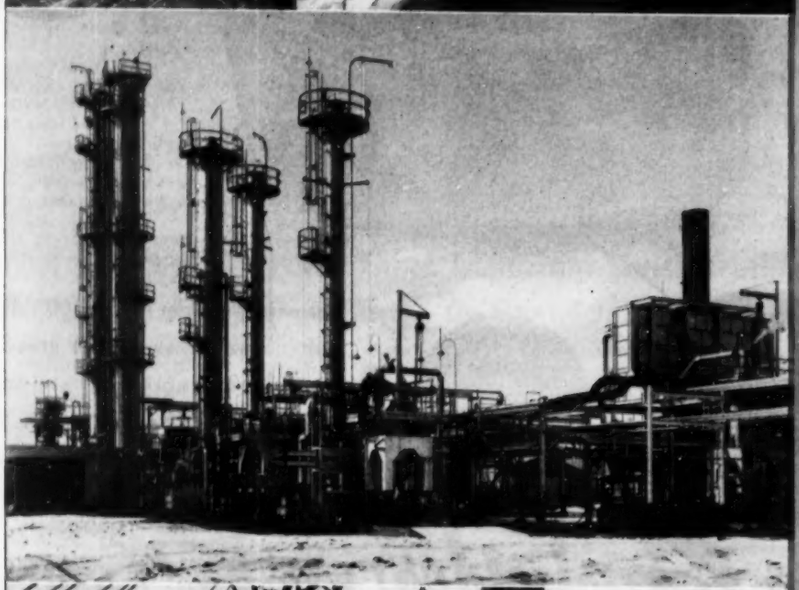

PROCON

can build . . .
has built . . .
is building . . .

Auxiliary refinery facilities
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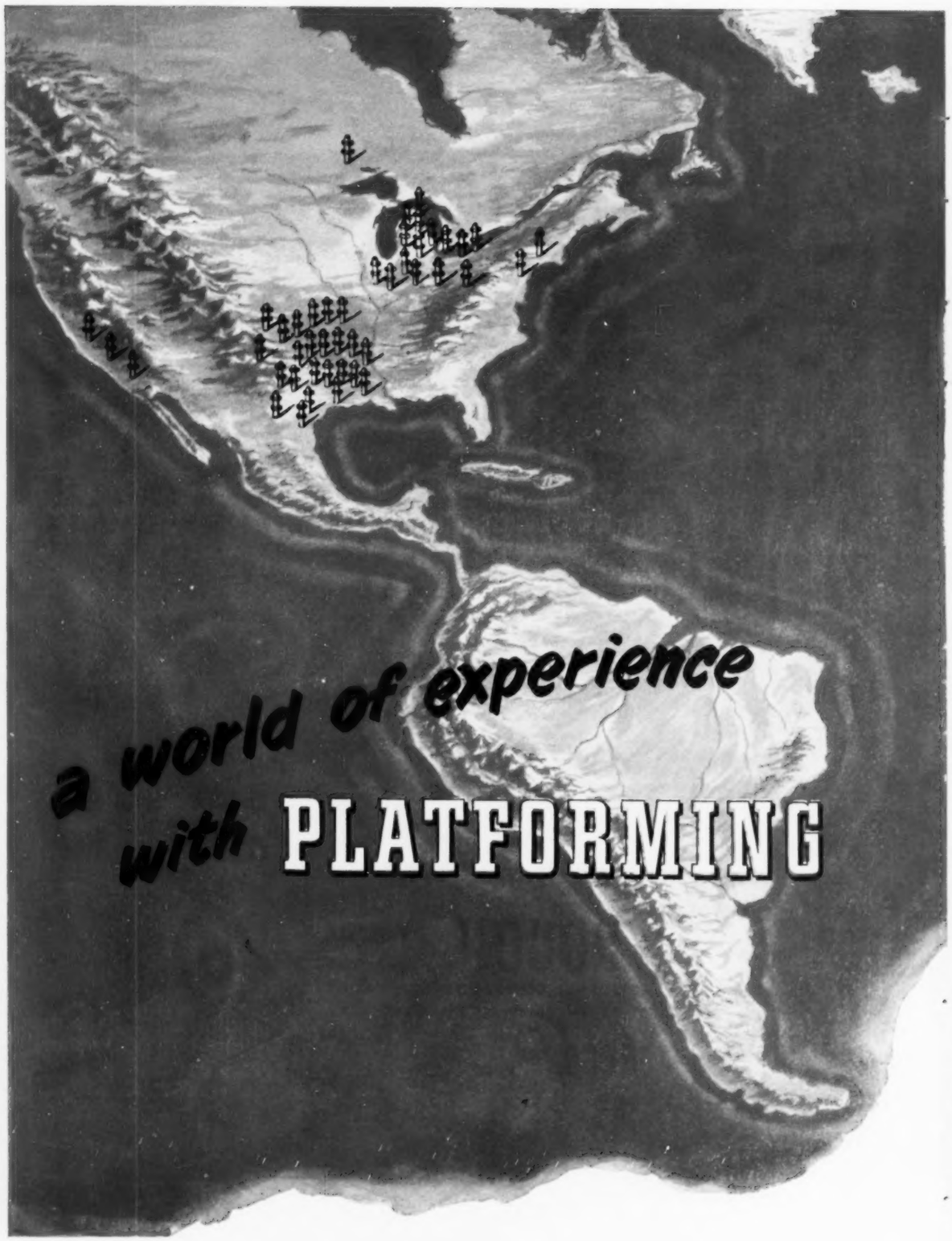
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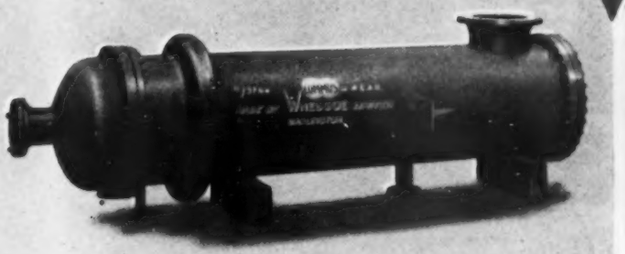
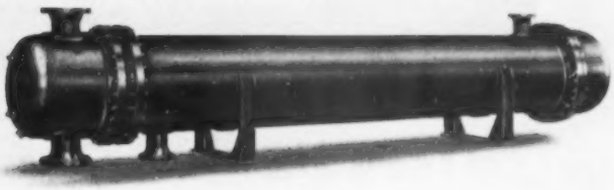
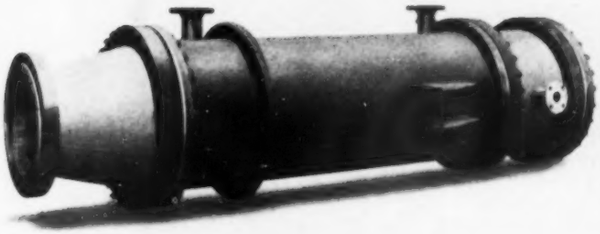


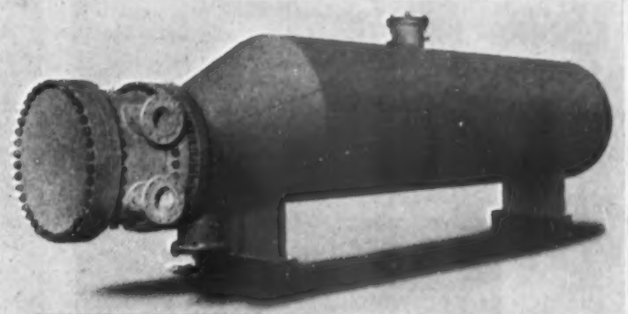
Column Reboiler—single-pass design (22" o.d.) of mild steel construction. Test pressures: shell and tubes 225 p.s.i.g.



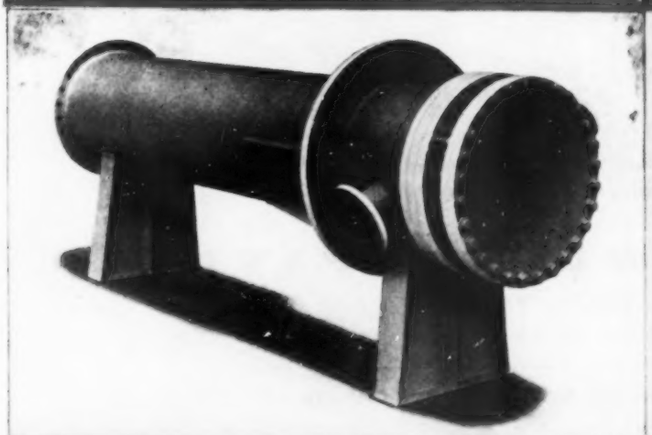
Heat Exchanger—2-pass floating head type (29" i.d.). Test pressures: shell, 500 p.s.i.g.; tubes, 550 p.s.i.g.



Condenser—single-pass up-flow design (25" i.d.)—with stainless steel tubes and 'Caltuf' steel shell and flanges. Test pressures: shell, 150 p.s.i.g.; tubes, 300 p.s.i.g.



Reboiler—2-pass kettle type (35"-54" dia.). Test pressures: shell, 225 p.s.i.g.; tubes, 590 p.s.i.g. Shell of steel construction, tube plates of chrome molybdenum.



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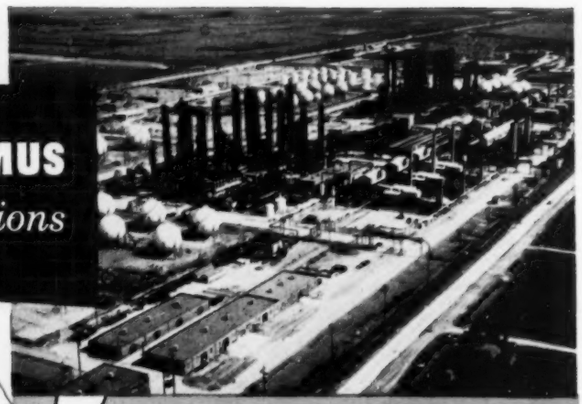

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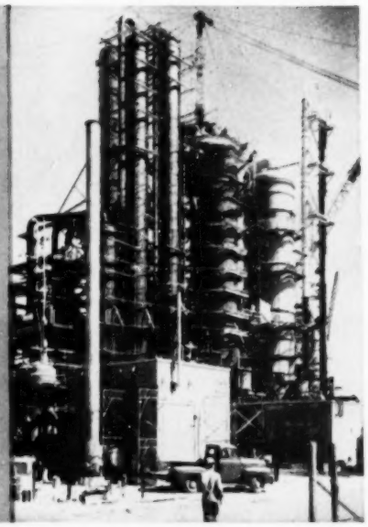

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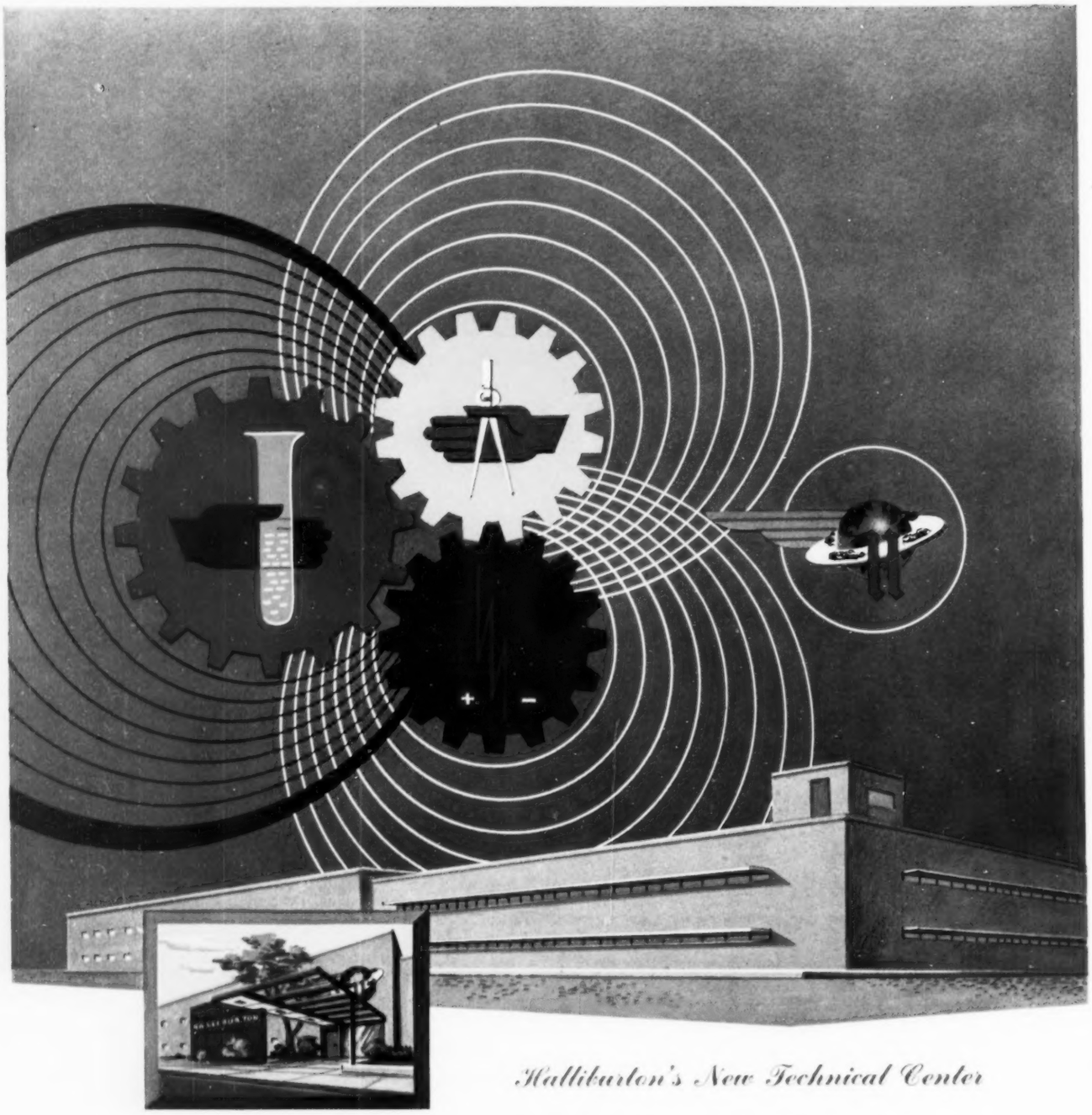
THIS MONTH'S COVER

Shamrock Oil & Gas Corp. recently completed a year's run of the cat cracker at its Sunray, Texas, refinery at 97.3 percent on-stream efficiency. The unit has a capacity of 11,000 b/sd. Boiling range of the charge exceeds 1,100° F., since heavy vacuum gas oil plus propane deasphalted gas oil from vacuum residue is processed. The Houdriflow unit pictured was erected by Catalytic Construction Co. Color plates are reproduced through the courtesy of Houdry Process Corp.



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PERPETUAL PROGRESS IN PRODUCTION IMPROVEMENT TECHNIQUES

NEW CHAPTER IN WORLD REFINING

ALONG WITH the rapid expansion in the search for new sources of petroleum supply which has assumed worldwide proportions within the past few years, there is taking place a similar broadening of activity in the processing branch of the industry. Not only is there a great upswing in the number and capacity of refining installations, but these are being distributed over a far wider area than ever before. When the bulk of the world's production was confined to a single nation it was natural that its processing should be restricted largely to the same geographical region. With production being extended to every quarter of the globe, however, and with universal recognition of the fundamental importance of petroleum as a factor in all industrial progress, there is increasing pressure to concentrate manufacturing operations with production and marketing.

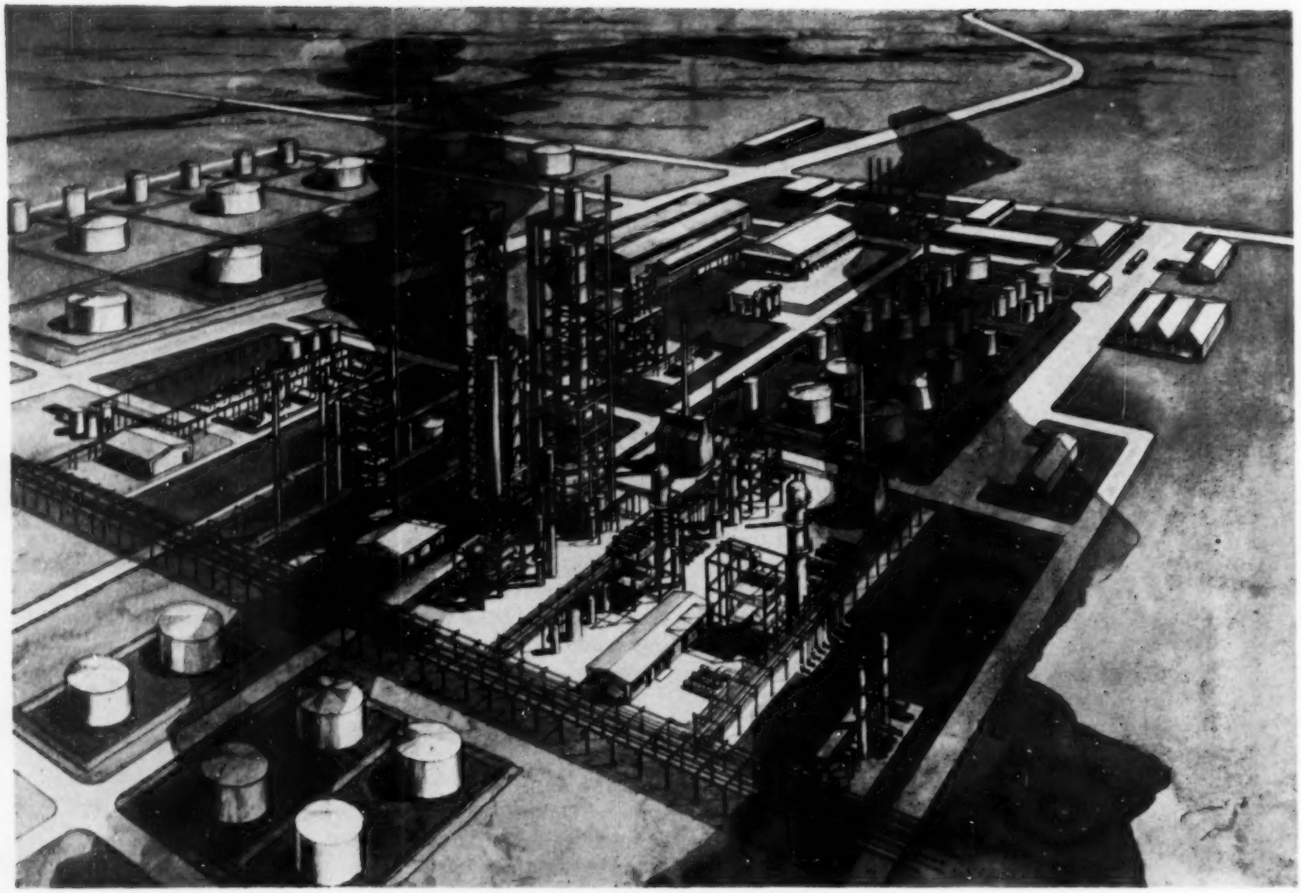
The change that has taken place is strikingly illustrated in Europe which, next to the United States, has long been the world's most important consuming area. No longer ago than 1947, the daily charging capacity of all refineries in Western Europe was 286,000 barrels. In 1953, the capacity of plants in this same area, including several approaching completion which will be in operation before the end of the year, has risen to 1,675,000 barrels, an increase of almost fivefold. The United Kingdom leads the way with a group of modern refineries having a throughput of more than half a million barrels daily. France has raised its processing equipment to a daily capacity of over 450,000 barrels. Italy has gone from 27,000 barrels daily to more than 200,000 and Germany has added 100,000 barrels to its potential daily refinery runs. All these countries, as well as a number of smaller ones, are now in a position to fill their entire requirement of petroleum products from plants within their own borders.

While the gap left by the closing of the world's largest refinery at Abadan still limits the output of the Near East, the enlargement of some of the plants in this area and the construction of others now being put under way is adding to facilities to such an extent that the loss will be largely made up within the next two years.

Markets of the Near and Middle East that formerly obtained their supply of products mainly from Abadan are presently to be served from plants located at points of strategic commercial advantage, such as the great new installation now under construction by Anglo-Iranian Oil Company at Aden. India and Pakistan are to have additional refineries within their own borders. No less than four plants of the most modern design and construction are scheduled for early completion in Australia to meet the expanding needs of the sixth continent. South Africa likewise is to have a new refinery, while the rapid growth in demand throughout the Pacific area points the way to new construction and expansion of existing plants there.

This diffusion of facilities through parts of the world heretofore dependent on distant sources of supply is certain to bring about important changes in the international refining industry. Not only will it result in substantial alteration of transportation routes, but the establishment of these modern and efficient plants will be reflected in the economic life of the area in which they are placed.

It is reasonable to assume that, as the petroleum industries of these various countries become more fully integrated and either directly or through related enterprises provide more employment for nationals of the countries in which they are established, the practical advantages of the industry will be better understood and the sentiment for maintaining it at an efficient level will be strengthened. Management has learned that, to place its petroleum operations upon an enduring basis, they must be closely identified with the progress of the peoples among whom they are located and must contribute in substantial ways to the improvement of their living standards. One way in which this is being brought about is through a steady and continuous growth in the consumption of petroleum products in all these lands. Fears of an overexpansion of producing or processing facilities are groundless when measured against the needs of the world at large and the constant addition which the industry itself is making to the number and range of its useful and essential products and services. The oil industry has become too big and too important in the field of human endeavor to remain in possession of a single nation or a handful of nations. It is responding today to the summons to a world destiny and an age of greater activity and usefulness than it ever before has faced.



Artist's drawing of new $30 million Standard-Vacuum refinery to be built near Melbourne, Australia. Completion by Braua-Transworld Corp. is planned for late 1954.

Worldwide expansion of refining marks 1953

MOST SIGNIFICANT feature of the refining industry in 1953 has been the spread of operations around the globe. New construction and expansion of plant facilities have continued at an unabated pace in long-established processing areas such as the refining centers of the United States, and appropriations for expanded facilities and the introduction of improved processes during the current twelve-month in the case of many companies have exceeded the lavish outlays of any of the past five years of record capital investment.

At the same time, the planning and building of new refineries in countries that heretofore have been without such manufacturing facilities or which have been inadequately equipped to supply their requirements in the way of petroleum products, establishes a record even more remarkable by comparison. Taking into account projects well under way and scheduled for completion by the end of the year or during 1954, it appears that in 1955 the world will be supplied with processing facilities of around 16 million barrels of daily crude capacity and that these facilities will be much more widely dispersed than at any time in the past. In fact, the ambitions of a number of countries have outrun the needs of their immediate markets to such an extent that they will have to depend on exports to keep their plants operating at capacity, a situation which presages a still more acute competition for international markets.

Additions to throughput capacity within the past year have raised the total outside the United States by nearly a million barrels daily or roundly 25 percent, bringing current capacity well above six million barrels daily. Projects authorized and now under way will add another half million barrels or more in 1954. Fears of possible overbuilding in this branch of the oil industry have been expressed in conservative quarters. Past experience shows, however, that the demand for petroleum products normally increases as fast if not faster than the means of supplying them can expand. The rapid progress of research and invention and the speed with which plants become obsolescent appears to put refinery builders in the position depicted in "Alice in Wonderland" where it is necessary to run at top speed just to remain stationary.

Details of progress in refinery expansion in countries where activity is particularly high appear on other pages of this issue in articles dealing with the United Kingdom, France, Germany, Italy and the Middle East. There are other countries, however, in which noteworthy developments are taking place. One such example is South Africa, where rapid progress is reported on the construction of the $22 million Standard-Vacuum refinery at Durban, giving hope that the 16,000 b/d plant may go on stream early in 1954.

Some 1,400 men, employees of Standard-Vacuum, Foster-Wheeler Corp. and South African sub-contractors, are on the job. All administration buildings on the 200-acre site are complete with the exception of final fitting-out of the cafeteria, laboratory and locker buildings. Warehouse, shop and chemical storage structures are finished. Underground electrical cables have been laid.

The main processing unit, a Model IV combination fluid cracker, reformer and distillation plant, is well advanced. Foundations, underground water piping, sewers and electrical cables are in place; structural steel and pipe supports are nearly complete. The naphtha stabilizer and combination tower, including fractionator-absorber, have been erected. The control house is complete, while foundations and steelwork for a blower and compressor house have been finished. Other process equipment, including SO_2 extraction, kerosine rerunning and doctor sweetening, are well advanced.

Six and 12-inch municipal water supply lines have been installed and crude receiving lines from the crude importing terminal at Island View in Durban harbor are ready to be tied in. Additional crude storage tanks are being erected at the terminal. Tank construction at the refinery for storage and processing is proceeding on schedule.

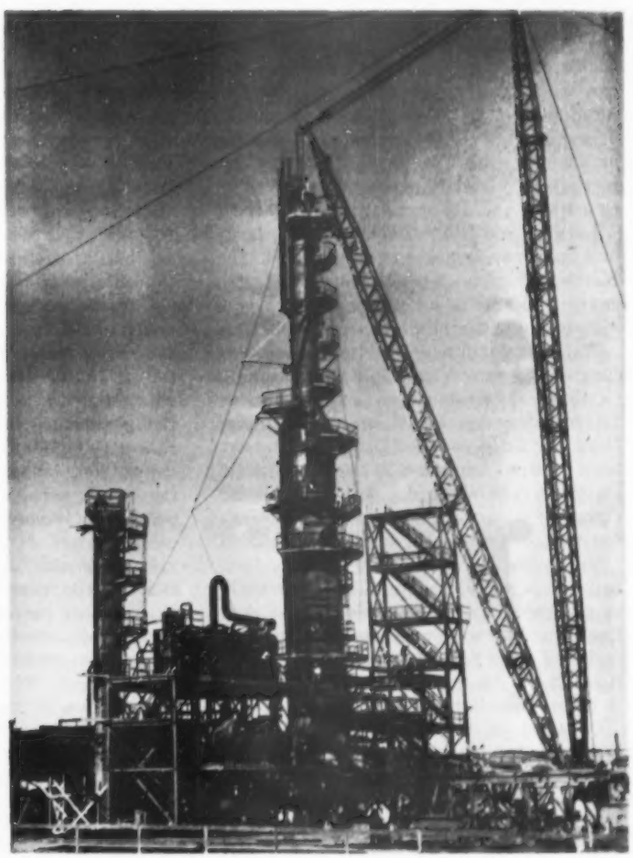
When completed, the refinery will process imported Middle East crude. The products will represent 21 percent of the Union's motor gasoline needs, six percent of power kerosine requirements, 33 percent of illuminating kerosine and 20 percent of automotive diesel needs.

Australia is to have a sixfold increase in refining capacity with the completion of plants now under construction or authorization. Work is in progress on the 62,000 b/d plant of Anglo-Iranian at Kwinana, while Shell is constructing a 25,000 b/d refinery at Geelong and Vacuum Pty. Ltd., subsidiary of Standard-Vacuum, is enlarging its plant at Altona, expanding its charging capacity to 25,000 b/d. Processing units include a 15,000 b/d TCC unit. These are all scheduled for completion in 1954. Australian Oil Refining Ltd., a Caltex subsidiary, has purchased a site at Kurnell near Sydney, where it plans to erect a 21,000 b/d plant scheduled for completion in 1955. This large expansion in Australian processing facilities is held to be justified by the continent's rapid increase in consumption of petroleum products.

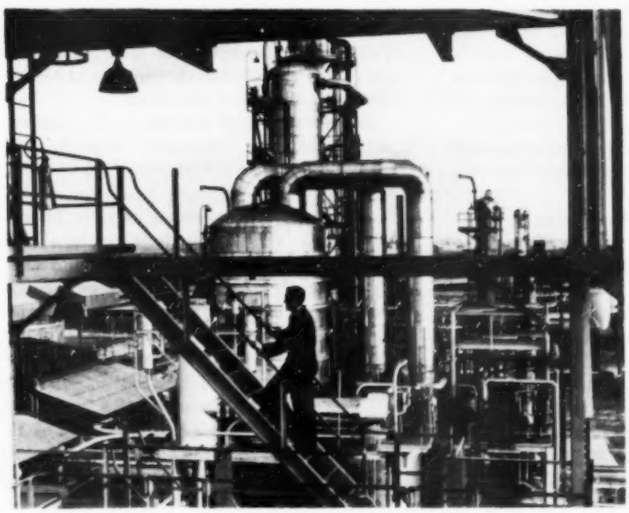
India is another country in the Middle East that is to have a substantial refining industry. Three new plants are to be added. One of these being built by Standard-Vacuum occupies a 280-acre site on Trombay Island near Bombay and is expected to reach completion by mid-1954. It will have a throughput of 25,000 b/d and represents an investment of some $35 million. A plant building by Burmah Shell, also located near Bombay, is designed for a 40,000 b/d capacity and is due for completion sometime in 1955. A third plant is to be erected by Caltex

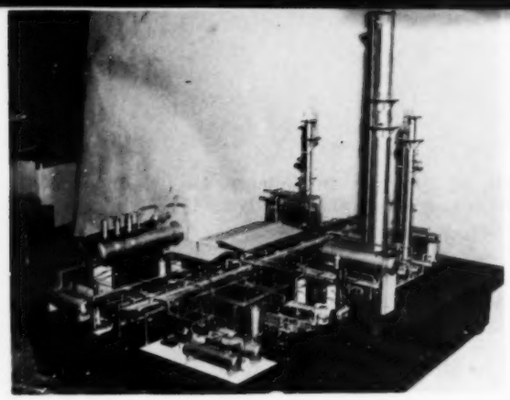
(Please turn to page 138)

Guy derrick at Standard-Vacuum's Durban, South Africa, refinery placing top section of fractionator-absorber tower for 16,000 b/d combination cracking, reforming and distillation unit. Section is 77 feet long and weighs 25½ tons.



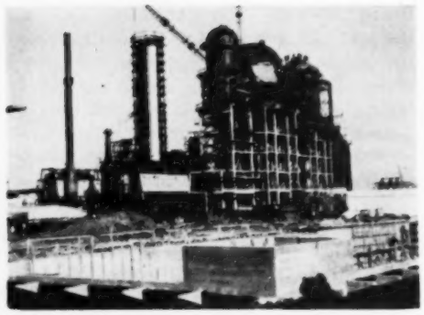
Mid-level view of the No. 2 distillation unit of Societe Industrielle Belge des Petroles S.A., (Anglo-Iranian-Fina) at Antwerp.





Model of alkylation unit to be built by Foster-Wheeler Corp. for Empresa Colombiana de Petroleo at Barranca Bermeja.

Western Hemisphere refineries continue active building



New cat cracker being built by Kellogg Pan American Corp. for Yacimientos Petroliferos Fiscales at the Eva Peron refinery.

In the Western Hemisphere outside of the United States there were at mid-year 109 refineries with a rated still capacity of 2,204,460 barrels daily. A year ago in this area, 108 plants reported a rated capacity of 2,031,480 b/d. Increase during the year was 171,240 b/d, or 8.4 percent. This compares with an increase of about 10 percent in the world as a whole and five percent in the U. S.

Largest South American changes were in Argentina, Trinidad and Venezuela. In North America, Canada continued its rapid building in an effort to catch up with booming demand.

A large portion of the new capacity completed was in Venezuela, where Shell-Caribbean Petroleum is completing a major expansion of its plant at Punta Cardon. Crude capacity at Cardon has been virtually doubled in the past year, rising to 145,000 b/d. This is now a complete refinery with modern facilities for the production of lubricating oils.

Venezuela refineries now produce the full line of petroleum products consumed in the country. Latest addition to the line is paraffin wax, which is being manufactured from San Roque crude by Phillips Oil Co. A description of this plant is given elsewhere in this issue.

Capacity of the Venezuela Gulf refinery at Puerto La Cruz now stands at 55,000 b/d, an increase of 15,000 barrels over the previous year. This plant refines crude produced by The Texas Co. and Mene Grande Oil Co.

Major project now in progress in Venezuela is the comprehensive expansion of Creole Petroleum Corporation's refinery at Amuay Bay. Now rated at 60,000 b/d, this plant is to be increased to 150,000 b/d at a cost of some $35 million. In addition to the erection of single stage atmospheric crude stills, Creole is building a 21,000 b/d naphtha fractionator to prepare feed stock for a 10,000-barrel fluid hydroformer which also is being built. Utilities for the plant are being enlarged.

The increase in domestic refining activity in Venezuela is beginning to affect the character of petroleum exports from that country. In 1952, exports of refined products were 11 percent greater than in the previous year, while crude exports rose 5.5 percent. Gasoline exports to Brazil were nearly doubled. The country now is self-sufficient in most refined products. Imports are restricted largely to specialties.

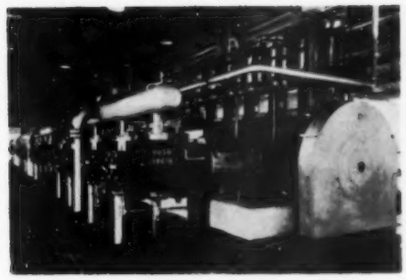
In Argentina work is nearing completion on the new refinery expansion of Yacimientos Petroliferos Fiscales at Eva Peron (formerly Puerto La Plata). Y.P.F. formerly operated an 85,000-barrel plant at this point. This is being enlarged by the erection of two new crude stills, a fluid cat cracker, vacuum feed preparation unit, delayed coker and an alkylation unit. Ultimate capacity on the basis of the present construction program will be about 113,000 b/d. Kellogg Pan American Corp. is building the plant for Y.P.F. Within the past year a products line was laid to deliver refined oils to metropolitan Buenos Aires.

Diadema Argentina S.A. de Petroleo is building a lubricating oil plant in connection with its 18,000 b/d refinery at Buenos Aires. The unit will have a capacity of 600 b/d when completed in 1954.

The addition to Argentine refining capacity comes at a time when demand seems to be rising at a rapid rate as Y.P.F. has been increasing indigenous production of crude from two newly discovered fields and, at the same time, stepping up imports of crude oil. First quarter imports of crude and products were 12 percent higher than the first quarter of 1952 and three percent above the last quarter of the year.

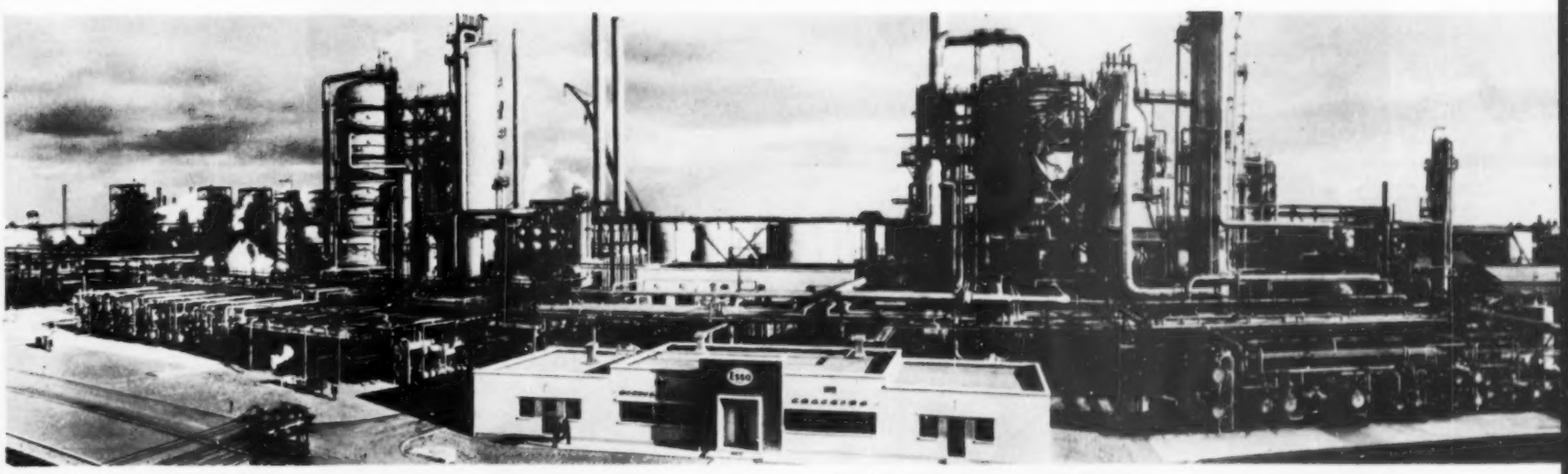
Argentina is, of course, still deficient in domestic oil supplies. Imports are running at the rate of about 40 million barrels yearly.

Among Latin American nations, booming Brazil is the most deficient of all in both domestic oil supplies and in refining capacity. National still capacity early this year was 4,750 b/d. Current building projects will double the capacity within the next few months. The government plant at Mataripe, Bahia will be doubled later this month with a rating at that time of 5,000 b/d. The plant is equipped for thermal cracking and catalytic polymerization. Ipiranga, S.A., Companhia Brazileira de Petroleos, is expand-



Group of Clark compressors at the Poza Rica gasoline and repressuring plant of Petroleos Mexicanos.

Petroleos Mexicanos is recovering elemental sulfur in this Claus Kiln at Poza Rica.



General view of Sarnia refinery of Imperial Oil Ltd. which has been enlarged and modernized within the past year.

ing its refinery at Rio Grande do Sul by adding thermal cracking as well as skimming facilities. Total crude capacity will be 6,000 b/d and 2,000 b/d thermal cracking. A 250 b/d asphalt plant is operating.

Most of the important new capacity being built in Brazil will not go on stream until late next year or in 1955.

Conselho is erecting a 45,000 b/d plant at Cubatao, near the port of Santos, to be completed early in 1954. In March 1953, a project was approved to raise capacity to 75,000 b/d. Two years, reckoned from the date of signing the contract for the work, will be allowed for completion.

Refineraria e Exploracao de Petroleo Uniao is to build a 20,000 b/d plant at Santo Andre, Sao Paulo, which is planned for completion at end of 1954. Refineraria de Petroleo de Manguinhos is to build a 10,000 b/d plant at Manguinhos, Rio de Janeiro, planned for completion at end of 1954. I. B. Sabba e Companhia has been authorized to install a 2,500 b/d plant at Manaos, on the Amazon.

Trinidad Leaseholds Ltd., at Point-a-Pierre, Trinidad, the largest refiner on the island, has been engaged in a major expansion which centers on cracking. A thermal cracker has been erected to process 25,000 b/d of reduced crude. Overhead cracking stock is produced from a vacuum feed preparation unit for the new 15,000 b/d cat cracker. Elemental sulfur is to be recovered in a Claus kiln which is in the process of construction.

In Peru the government has decided to transfer the Empresa Petrolera Fiscal refinery at Villar, south of Zorritos, to Iquitos on the upper Amazon, Dept. of Loreto. The move will involve transporting the equipment 6,000 miles from the Pacific to the Atlantic coast and thence up the Amazon. At Iquitos, the Empresa plant has been running only spasmodically. In 1952 it was operated only 50 days to process 49,107 barrels of oil. Capacity is 1,000 b/d. Ganzo Azul now operates a 700 b/d skimming plant at Aguas Calientes on the Amazon. Products from 198,659 barrels of crude were marketed locally last year. The principal refinery in Peru is the International Petroleum Co. plant at Talara which processed 11,246,855 barrels of crude in 1952.

In Colombia, Empresa Colombiana de Petroleos has let contracts for the erection of equipment to increase the gasoline yield of the Barravea Bermeja refinery which Tropical Oil Co. operates under contract. Equipment to be installed includes a fluid cat cracker and an alkylation unit plus treating facilities.

Like many other countries in Latin America, consumption of petroleum products is rising rapidly in Mexico. Although production has been rising, local demand is such that exports had to be reduced a third from 22,561 barrels in 1951 to 15,436 barrels in 1952, exclusive of bunkers.

The growth in demand is causing Petroleos Mexicanos to undertake a new long-range construction program to supplement the work completed in recent years.

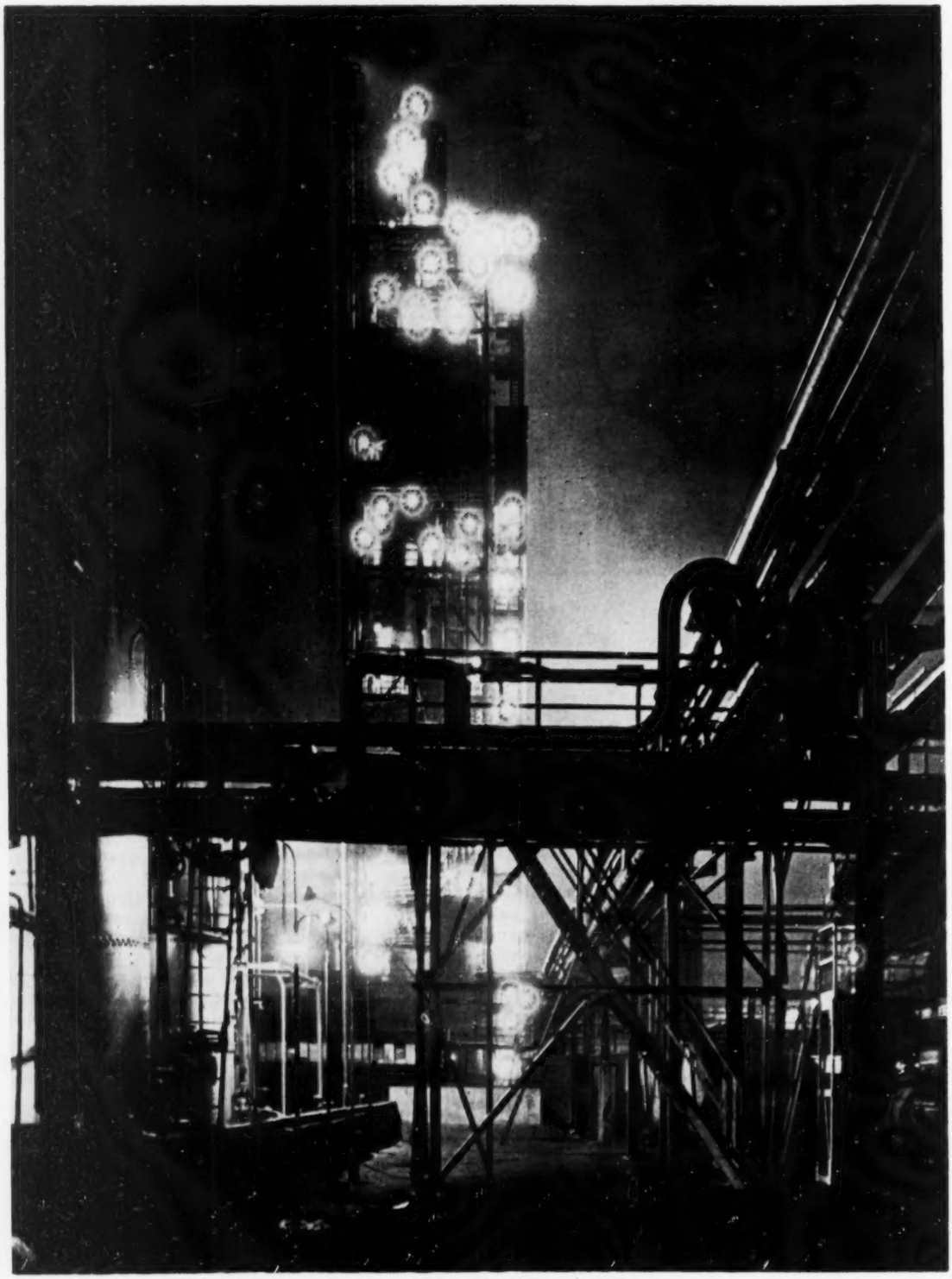
At Tampico, Pemex will build a 15,000 kw power plant, a 20,000 b/d rerun still, a feed preparation unit, a catalytic polymerization plant, and a 20,000 b/d cat cracker. Completion in 1955 is planned. At Reynosa, Tamp., the present 4,000 b/d topping plant will be enlarged to 10,000 b/d by early 1954.

A new 30,000 b/d topping unit is to be built at Minatitlan, Ver., to supplant a present 8,000 b/d still. A cat cracker, feed preparation unit and polymerization plant will be built and the power plant enlarged. The third quarter of 1955 is target date for completion.

A similar expansion program is being developed for the "18th of March" refinery at Atzcapotzalco for 1957 completion. Plans include a 30,000 b/d topping unit, 8,000 b/d cat cracker, vacuum unit, alkylation plant and utilities expansion.

To increase the local supply of wax and lubes, the Salamanca, Guanajuato, refinery will be enlarged. The new facilities will produce 2,600 b/d of lubes and 65 tons of wax beginning early in 1955.

Canada will increase national refining capacity 69,000 b/d this year and expects to be able to meet domestic demand for most products by 1954. A detailed report on Canada was given in the May issue of WORLD PETROLEUM.



Night view of the 8,000 b/d TCC cracking unit at the Deutsche Vacuum Oel A.G. refinery at Bremen-Oslebshausen. The cracker went on stream in March.

Residuum processing is problem of German

Esso A.G. is expanding the Esso-Ebano refinery at Harburg in Hamburg harbor by the erection of a fluid cat cracker, vacuum unit and lube plant. The refinery formerly was largely engaged in the manufacture of asphalt.

refining industry

By Alfred M. Stahmer

IN THE COURSE of the last 12 months, West Germany's mineral oil refining industry has made further progress. Under the European refinery expansion program, the building up of new capacities was continued and the treating of German and foreign crude oil was stepped up considerably to keep up with the growing home demand.

The traditional source of industrial power in Germany is coal, which is mined in ample quantities in the Ruhr district. While fuel, besides coal, has become of increasing importance in the neighboring countries (e.g. France and England), in the course of the last few years, in Germany it has not succeeded in finding a noteworthy market as industrial energy. It is true that several hundred thousand tons per annum are being used for bunkering purposes, and various cement factories and power stations are using fuel oil, but by comparison with other countries, consumption in Germany still is and probably will continue to be relatively very low, all the more so as the high railway freight rates and fiscal dues have a prohibitive effect, and many consumers are hesitant to risk a long-term conversion of their plants to the use of fuel oil. In 1952, France consumed 7.2 million tons of fuel oil and West Germany only 934,000 tons.

It is obvious that the working up of distillation residues has become the main problem of mineral oil processing. To handle this, four hydrogenation works which previously had practised liquefaction of coal, viz., Wesseling, Gelsenberg, Scholven and Welheim, changed over to topping crude and processing the residues. Moreover, numerous thermal and catalytic cracking units are newly erected or have been planned. There is now only a small number of minor plants which confine themselves to crude topping. At present practically all plants are equipped with facilities enabling them to process residues to lubricating oil or bitumen, or to crack or hydrogenate these residues. It goes without saying that this general structural trend calls for large investments which most of the oil companies are able to make only after taking up foreign loans.

A year ago we published a list of the crude intake capacity of the West German refineries which then amounted to an annual total of 6,732,000 tons. As a result of the expansion of existing plants and the erection of new units, the topping capacity has in the meantime gone up to 8,135,000 tons (as of the beginning of 1953). After completion of the building projects in hand, it is expected that an annual intake capacity of 11.2 million tons of crude will be reached by the end of 1954.

West Germany's home consumption of mineral oil products has risen from 5.06 million tons in 1951 to 5.79 million tons in 1952, and will probably go up to about

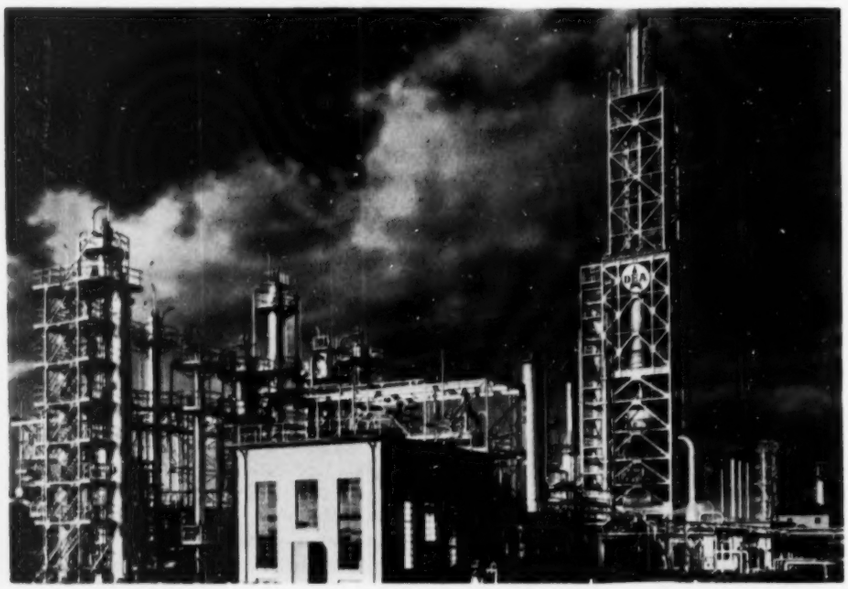
eight million tons in the course of the next two years. Thus, in general, the refinery capacity suffices to meet the home demand. If the capacity of the plants could be fully utilized, there might even be a large surplus for exports. It is, however, impossible to regulate the output of any one product in such a way that it precisely corresponds to the demand. Germany's consumption of diesel oil is relatively high because many trucks, tractors, and for the past few years, passenger cars are using diesel oils as motor fuel. Diesel oil output by refineries and hydrogenation works is unable to satisfy the requirements, therefore during 1952 an additional quantity of 450,000 tons of diesel fuel had to be imported from abroad.

Since several new cracking units have been put on stream, there is a surplus of motor gasoline requiring a market outlet abroad. In the course of the last few months, indigenous production of lubricating oils has also surpassed home requirements.

In 1952, exports of mineral oil products, for the first time since the war, were resumed to any mentionable extent. During that period a total of 528,000 tons of finished products was exported, 226,000 tons thereof being motor gasoline (chiefly to England and Denmark), and 169,000 tons of fuel oil, the bulk of which was sold to foreign ships in German ports. Furthermore, 84,600 tons of lubricating oil, 23,400 tons of bitumen and 8,800 tons of petroleum coke were exported. LPGas from German hydrogenation works and refineries was also marketed in foreign countries.

In 1952, West Germany's refinery output totalled 5,139,212 tons, exceeding that of 1951 by 12.7 percent. Since indigenous crude production from the oil fields in Lower Saxony, Holstein and Baden is steadily rising, the share of German crude in the total refinery intake went up from 28.5 percent in 1951 to 32.4 percent in 1952.

The German Refiners' Association (AEV) has drawn up a processing program for 1953 which forecasts a total output of 6.98 million tons of finished products.



Deutsche Erdoel-AG's refinery at Hemmingstedt, first of Western Germany's catalytic cracking units. Designed by Hydrocarbon Research, Inc., New York, and Hydrocarbon Mineraloel G.m.b.H., Dusseldorf, and erected in collaboration with Edeleanu G.m.b.H., Frankfort, this 10,000 b/d TCC (Socony) unit went on stream in October 1952.

According to this scheme, the total intake of refineries and hydrogenation works will consist of 2.09 million tons of German crude, 4.38 million tons of Middle East oil (chiefly Aramco and Iraq), 645,000 tons of Tia Juana and Lagunillas crude from Venezuela, and 100,000 tons of Panuco crude from Mexico. About one-half of the crude imports will come from Dollar concessions and the other half from Sterling areas. The plan provides for an output of only 1.04 million tons of fuel oil, whereas 2.45 million tons of motor gasoline are to be turned out, 1.95 million tons of diesel fuel, 0.59 million tons of bitumen and 0.43 million tons of lubricants.

Perhaps the outstanding event of the past 12 months was the completion of the first two German catalytic cracking units, one belonging to Deutsche Erdoel-AG and the other to Deutsche Vacuum Oel AG (affiliate of Socony-Vacuum). Both these plants employ Socony's Thermofor catalytic cracking method.

The newly erected TCC cracker of Deutsche Erdoel-AG at Hemmingstedt, situated in the area of the oil field Heide (Holstein province), started operation in early October 1952. Contractors were Hydrocarbon Research, Inc., New York, and Edeleanu GmbH of Frankfort. Whereas by normal distillation the local Heide crude yields only 16-18 percent of gasoline, the catalytic cracking method ensures a gasoline output of approximately 50 percent. The total motor fuel yield (including LPGas and diesel oil) amounts to no less than 70 percent of the crude intake. The remaining unsplit fractions of crude are used as fuel oil and are partly exported to Denmark. The cracked gasoline has an octane number of 78-80 and requires no leading. The quality of motor fuel is further improved by an admixture of polymer gasoline from cracking gases obtained in a special polymerization plant.

As catalyst, the Heide plant uses aluminum silicate pellets which for some months have been supplied by a new factory of Kalichemie at Nienburg on the river Weser. The capacity of the TCC unit at Heide is 300,000 tons a year. The total annual crude intake capacity of this refinery is thereby stepped up to 450,000 tons. Two 20-mile pipe lines with a diameter of 6 and 5 inches respectively are being built to link up the Heide plant with the terminal Brunsbuettelkoog, Kiel Canal. Products of the plant can be shipped to the terminal and additional crude from abroad can be transported to Heide.

The second TCC cracking unit in Germany, which was put on stream in March of this year, was erected on the site of the Vacuum refinery at Bremen-Oslebshausen which previously had topping plants and facilities for refining high quality lubricants only. Construction of the cracker was begun in September 1951 and finished in January 1953. Since its completion, the refinery now has a total annual throughput capacity of 700,000 tons of crude. About 40,000 tons of Arabian crude and 10,000 tons of German crude oil will be processed per month to produce motor fuels and lubricating oils. At a full utilization of the capacity, i.e. at an intake of 710,000 tons per annum, the output would include, among other products, about 234,000 tons of gasoline, 197,000 tons of gas oil, 148,500 tons of fuel oil, 39,000 tons of LPGas and about 7,000 tons of fuel gas. The same catalyst is used at Oslebshausen as in the Heide plant. The white products of the refinery are distributed by the BV-Aral organization. Socony-Vacuum has no filling stations of its own in Germany.

In July 1950, Gewerkschaft Erdoel-Raffinerie Emsland, Lingen, which is jointly owned by the crude oil producers Wintershall AG and Gewerkschaft Elwerath (65:35), started the erection of

a TCC (Houdry) cracking plant at Lingen-Holthausen, in the neighborhood of the Emsland fields. The cracking tower, 102 meters high, was fitted by Maschinenfabrik Augsburg-Nurnberg MAN in January of this year. It is expected that the plant at Holthausen will be put on stream in the course of this summer. For the remainder of 1953, a throughput of 205,000 tons of Emsland crude is planned, whereas from 1954 onwards the full annual capacity of 500,000 tons of crude oil will be utilized. At Lingen, the cracking residues will be processed to give petroleum coke (coke for electrodes) which is a desired export article for the aluminum industry in the neighboring countries.

At Harburg, in the southern part of the district of the Hamburg harbor, the Esso AG, subsidiary of Standard Oil (New Jersey), runs the Ebano refinery which previously had been mainly a special bitumen factory. For two years Esso-Ebano has been expanding its plant by erecting an SOD fluid catalytic cracking unit, a lubricant refining unit and a vacuum still on an adjacent site of 60 acres. Probably the new cat cracker will be put on stream before the end of this year. Ebano, which up to now treated about 700,000 tons of crude per annum, will then have an annual intake potential of 1.75 million tons of crude. For the storage of crude oil and finished products, several tanks of 20,000 cubic meters capacity each are being built. According to American practice, the roofs of these tanks will be constructed in such a way that they will float upon the oil surface to prevent gas accumulation. This will be the first time that this method is applied in Central Europe. The costs of enlarging and modernizing the Harburg plant will amount to about 40 million DMarks.

In WORLD PETROLEUM'S report of July 1952, we described the expansion plans of the four German hydrogenation works, i.e. Gelsenberg Benzin AG at Gelsenkirchen, Union Rheinische Braunkohlen-Kraftstoff AG at Wesseling near Cologne, Scholven-Chemie AG at Gelsenkirchen-Buer, and Ruhroel GmbH at Bottrop-Welheim. At Gelsenberg, the erection of a TCC cracker (Socony type) designed by Hydrocarbon Research, Inc., and a Lummus-Lurgi polymer gasoline plant are on the verge of completion. At Wesseling a newly erected thermal cracking plant with an annual intake of 420,000 tons, as well as additional reforming and polymer units (projected by Hydrocarbon), were put on stream in the beginning of this year. Scholven is building a Kellogg-Orthoflow catalytic cracking unit. In all these three hydrogenation works the crackers are to make oil processing more flexible. Partly, the crude is being, or will in future be, treated in three stages: distillation, cracking, and hydrogenation of cracking residues. By this or similar (cycling) methods, the percentage of final residues is reduced to a minimum.

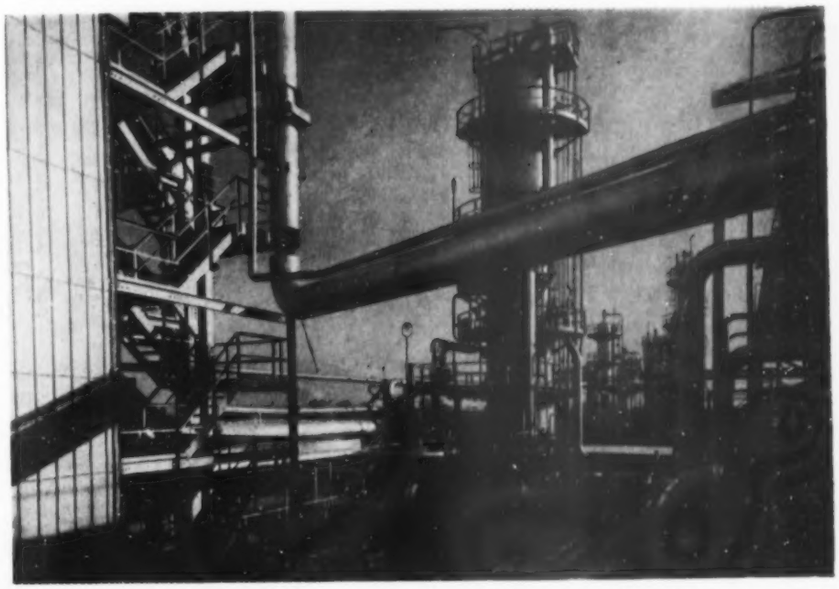
Construction of a small thermal cracking unit with Perco reforming at the plant of Ruhrchemie, Oberhausen-Holten, has as yet not been completed. The French company Omnipetrol owns a share in this plant which will be supplied with crude by the Gulf Oil Corporation. It is hoped that this cracker will start operating before the end of this year.

Considerable enlargement and modernization is under way at the refinery of BP Benzin und Petroleum GmbH (affiliate of Anglo-Iranian Oil Co.) in Hamburg-Finkenwerder, near the petroleum harbor. Annual capacity of the refinery previously amounted to about 700,000 tons of crude. An additional distillation plant is under construction which will have an annual potential throughput of 580,000 tons. A Platformer with an annual capacity of 330,000 tons which was originally designed for a plant in Burma is being installed. After completion of these new units, the Finkenwerder plant will have an annual intake capacity of about 1.25 million tons of crude which will chiefly come from Iraq.

Two well-known refineries of lubricating oil which are processing German crude, viz. Gewerkschaft Neue Erdoel-Raffinerie Nerag at Misburg near Hannover, and the plant of Wintershall AG at Salzbergen on the river Ems, have also been modernized. Nerag added to its facilities a polymerization and reforming plant. Salzbergen erected a new combined topping and vacuum distillation unit (Lurgi) and a plant for dewaxing and selective refining. An improvement in the refining of lubricating oil is also planned at Oelwerke Julius Schindler GmbH, Hamburg-Neuhof. The majority of the shares in this refinery is now in the hands of the Anglo-Iranian Oil Co.

In Germany special attention has recently have been drawn to the chances for developing petrochemical production on the basis of gaseous hydrocarbons from cracking plants. The Act introducing the new system of mineral oil taxes and duties, which became effective June 1, makes it possible to use cracking gases and other mineral oils for this purpose because it has reduced the heavy fiscal dues on these products. It may be a sign of future activity along this line that the chemical works of Bayer-Leverkusen (formerly IG-Farben) obtained a 50 percent interest in the refinery of Ruhrbau GmbH at Muelheim, whereas 25 percent each of the shares remained with Hugo Stinnes oHG and Brabag.

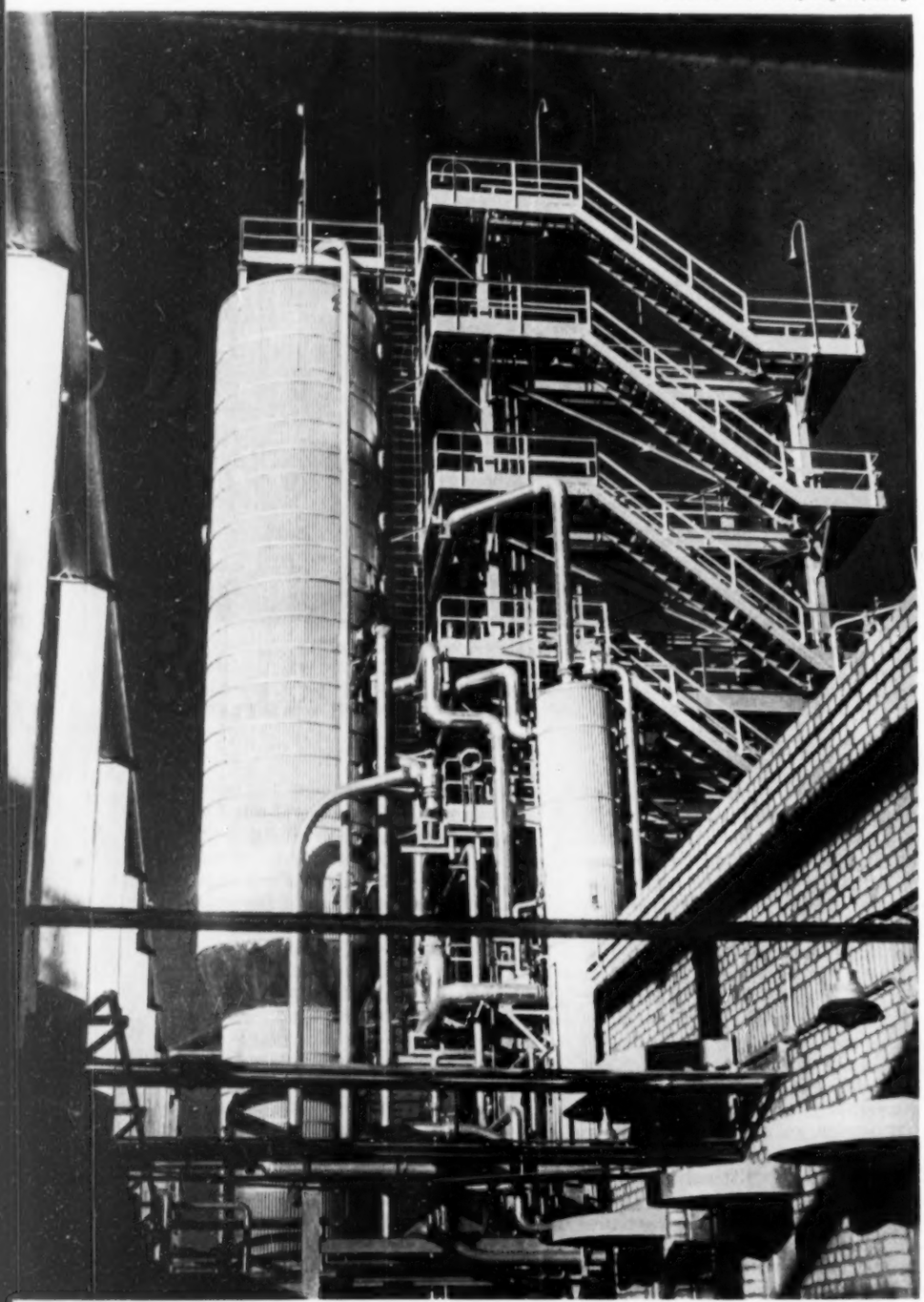
In the beginning of this year West Germany's mineral oil industry could depend on the following annual capacities to treat the residues: 950,000 tons hydrogenation, 860,000 tons thermal cracking, 300,000 tons catalytic cracking, 365,000 tons reforming, 486,000 tons lubricant refining, and 229,000 tons gasoline rerunning. With the completion of the above-mentioned new cracking plants, this second-stage capacity will increase considerably.



Another view of Deutsche Erdol-AG'S Heide plant with the TCC structure in the left foreground and the main fractionator tower in the center. Behind the fractionator can be seen the "California" catalytic polymerization unit which utilizes phosphoric acid supported as a liquid film on quartz particles.

Refineries of the Middle East

Distillation column at Kuwait Oil Company refinery.



By E. Lawson Lomax

THE IMPORTANCE of the refineries situated in the Middle East has in the past been overshadowed by the refinery of the Anglo-Iranian Oil Co. at Abadan, which, until it was shut down in 1951, was the largest operating refinery in the world and was the principal supplier of refined products both in the Middle and Far East.

With the stoppage of supplies from this source, the remaining refineries have advanced in importance and are now the main sources of supply of refined products in the Middle East.

At the present time the principal operating refineries in the Middle East are as follows:

Arabian American Oil Co.'s refinery at Ras Tanura.

Bahrain Petroleum Co.'s refinery on Bahrain Island.

Kuwait Oil Co.'s refinery at Kuwait.

Iraq Petroleum Co.'s refinery at Tripoli.

Consolidated Refineries Ltd., refinery at Haifa.

Khanaqain Oil Co.'s refinery at El Awand (operated for the Iraq Government).

Total crude capacity is in the neighborhood of 400,000 bbls. per day. It should be noted however, that the Haifa refinery is at present running only to about quarter capacity, but if running at full capacity this amount would be increased to about 450,000 b/d.

In addition to the above refineries, construction has started on a new refinery at Beiji, in Iraq, with a capacity of 24,000 b/d. This refinery is being built for the Iraq Government.

The present refineries have no plant for the manufacture of lubricating oils but a certain amount of bitumen is made to supply local needs.

The refinery of the Arabian American Oil Company at Ras Tanura, Saudi Arabia, came into operation just after the close of World War II in 1945, its completion having been hastened to meet the heavy needs of the United States Navy in that part of the world. Originally designed for a throughput of 50,000 barrels daily, additions to its capacity which have been made from year to year have raised this figure to 189,000 barrels per day.

Completion of a crude topping unit, which went on stream in March last, will enable the refinery to handle another 26,000 barrels of crude runs daily. Interestingly enough, this unit has been made up of elements taken from the Dhahran stabilization plant, together with other ancillary parts which are being fabricated locally.

The present distillation plant consists of two atmospheric-vacuum units of 100,000 b/d capacity each, built by Bechtel from a Standard Oil of California design, and a crude topping unit or fuel stripper of 6,000 b/d capacity.

The pipe still units of the atmospheric-vacuum units are gas fired, with alloy tubes in the radiant sections and carbon steel tubes in the convection section.

From the atmospheric column the products are overhead gasoline to the re-run column and a stripped kerosine side-cut, the bottoms going to the vacuum column which gives gas oil overhead and fuel oil bottoms.

The products from the re-run column are overhead gasoline to stabilizer column and heavy naphtha bottoms which go to a reforming unit.

The products from the stabilizer columns are light gas overhead, which goes to refinery fuel, and stabilized gasoline.

There are two UOP reforming units with a capacity of 13,000 b/d each which give overhead gas to refinery fuel, cracked or reformed gasoline and bottoms to fuel.

The furnace tubes of these reformers are made of 15.8 chromium nickel steel which permits the use of thinner-walled tubes than would be required otherwise and also increases capacity.

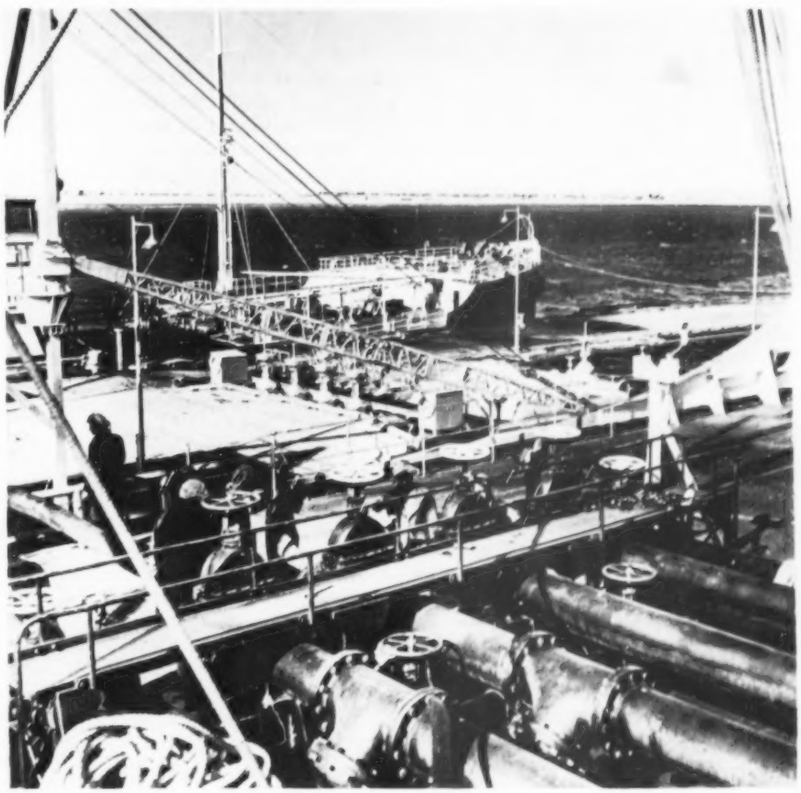
The products from the 6,000 b/d topping unit are overhead gas to refinery fuel, naphtha going to the re-run units of the atmospheric-vacuum plant and reduced crude for fuel oil.

A new topping unit is at present being built with a designed capacity of 20,000 b/d, and with an integrated re-run column. When this is complete, the crude capacity of the refinery will be of the order of 226,000 b/d.

The straight run gasoline and the cracked gasoline from the reformer are treated separately and then blended be-

Maintaining shipping terminal lines of Bahrain Petroleum Company Ltd. refinery.

In excess of one million barrels of crude and products have been shipped in a single day from the Kuwait Oil Company docks.



fore leading. The straight run gasoline is first given a caustic soda wash and then a final treatment of lead sulfide while the cracked gasoline, in addition to the above treatment, is given a final clay wash. The blended gasolines are then given 1.4—1.5 cc per gallon of ethyl fluid. Kerosine, as stripped from the side stream of the atmospheric column, is given a lead sulfide treatment.

Gas oil and diesel oil are not treated in any way.

In addition to the above refinery plant, there is an asphalt plant of 750 b/d capacity. This is a vacuum distillation plant, the charge being reduced crude, and is run to give asphaltic bottoms to the required penetration figure. The raw asphalt is then air blown to market requirements and shipped mainly in drums. The overhead and side distillates are blended to fuel.

In addition to the new distillation unit already noted, it is proposed to build a catalytic polymerization plant to deal with the gases produced by the reforming units. The products from this unit, which is expected to be completed in 1953, all increase the gasoline yield and improve its quality.

The power plant at Ras Tanura, in addition to providing power for the refiinery, terminals and auxiliary services, helps, along with surplus power from the Abqaiq power plant, to supply the whole of the electric power for the plant and the township of Dhahran.

Steam generation is by three Foster-Wheeler boilers working at 600 psi, 750°F superheat, of a capacity of 220,000 pounds per hour each, and are fired with low pressure gas from the refinery and de-gassing plants.

Current is generated in General Electric turbo-generators, 18,000 kw, both exhausting and by-passing for use in pumps and as process steam.

Water for boilers and domestic purposes is drawn from wells and is first Permutit treated and then distilled, the distillate being further conditioned for use domestically and in the boilers. Sea water is used for condensing purposes and for fire services.

Water is drawn from the sea by low lift pumps discharging into a concrete service canal, from which it is pumped by high lift pumps at a discharge pressure of 40 pounds for use in condensers, there being a separate ring main for fire fighting services.

Four pumps, each of a capacity of 35,000 gallons per minute, are used for the low level service, and three of a capacity of 25,000 gallons per minute are installed in the high level pumphouse.

An oxygen plant, working on the Claus system, and with a capacity of 180 to 200 standard size oxygen cylinders, is installed, sufficient to supply all the requirements of Aramco in Saudi Arabia for its welding and other operations requiring this gas.

There are two deep water jetties at the Terminal. The south jetty has 33 feet of water at low tide and berths for five tankers to load at once, the maximum size which can be berthed being equivalent to a T2 tanker.

This jetty is used for the dispatch of refined products mainly, but crude oil and fuel oil can also be loaded.

The north jetty has 40 feet of water at low tide, and super-tankers can be berthed at it, there being two berths for such vessels which can be loaded simultaneously.

This jetty is used only for loading crude oil and bunkers. Both jetties are fitted up with all the necessary appliances for easy and clean handling of the products to be loaded.

There is sufficient tankage for crude oil at the terminal to take care of seven days' production of export crude.

There is also storage for the following quantities of finished products:

PRODUCT	BARRELS
Gasoline	400,000
Kerosine	380,000
Diesel and Gas Oil	900,000
Fuel Oil	1,000,000

In addition there is storage for 700,000 barrels of aviation gasoline which is imported.

There are separate residential quarters provided for the various grades of staff employed in the refinery and terminal. The general labor-staff quarters are located at Rahaima, the intermediate staff at Rakhava and the senior staff at Nejma.

Among the many recreational facilities provided for the staff are halls and picture houses for the senior and intermediate staff. There are soccer fields for all staffs, tennis courts, basketball and baseball facilities, and an eighteen hole golf course.

Bahrain Petroleum Co.'s refinery on Bahrain Island has a nominal capacity of 155,000 b/d, but has been run at times at 175-185,000 b/d.

The crude feed for this refinery is approximately 30,000 b/d of Bahrain crude and the remainder a mixture of Saudi Arabian crudes, which is received by tanker or by an underwater pipe line from Saudi Arabia having a nominal capacity of 165,000 b/d.

The crudes range from 32.9 to 35° API, 0 to 15°F pour point, 1.3 to 2 percent by weight sulfur and from 1.7 to 2 percent wax (Holde).

From this crude the refinery produces several grades each of motor gasoline, illuminating kerosine, jet fuel, diesel gas oils, fuel oils and asphalts, and minor quantities of liquid butane.

In this refinery there are four conventional atmospheric crude distillation units with a combined nominal capacity of 155,000 b/d. In addition there is a temporary unit which has been built from otherwise idle processing equipment. There are three vacuum distillation units for the production of bitumen residues and feed stocks for the cracking plants. There are also one Universal Oil Products single-stage fluid catalytic cracking unit with a nominal capacity of 25,000 b/d, and two UOP two-coil Dubbs thermal cracking units with a combined capacity of 15,700 b/d nominal.

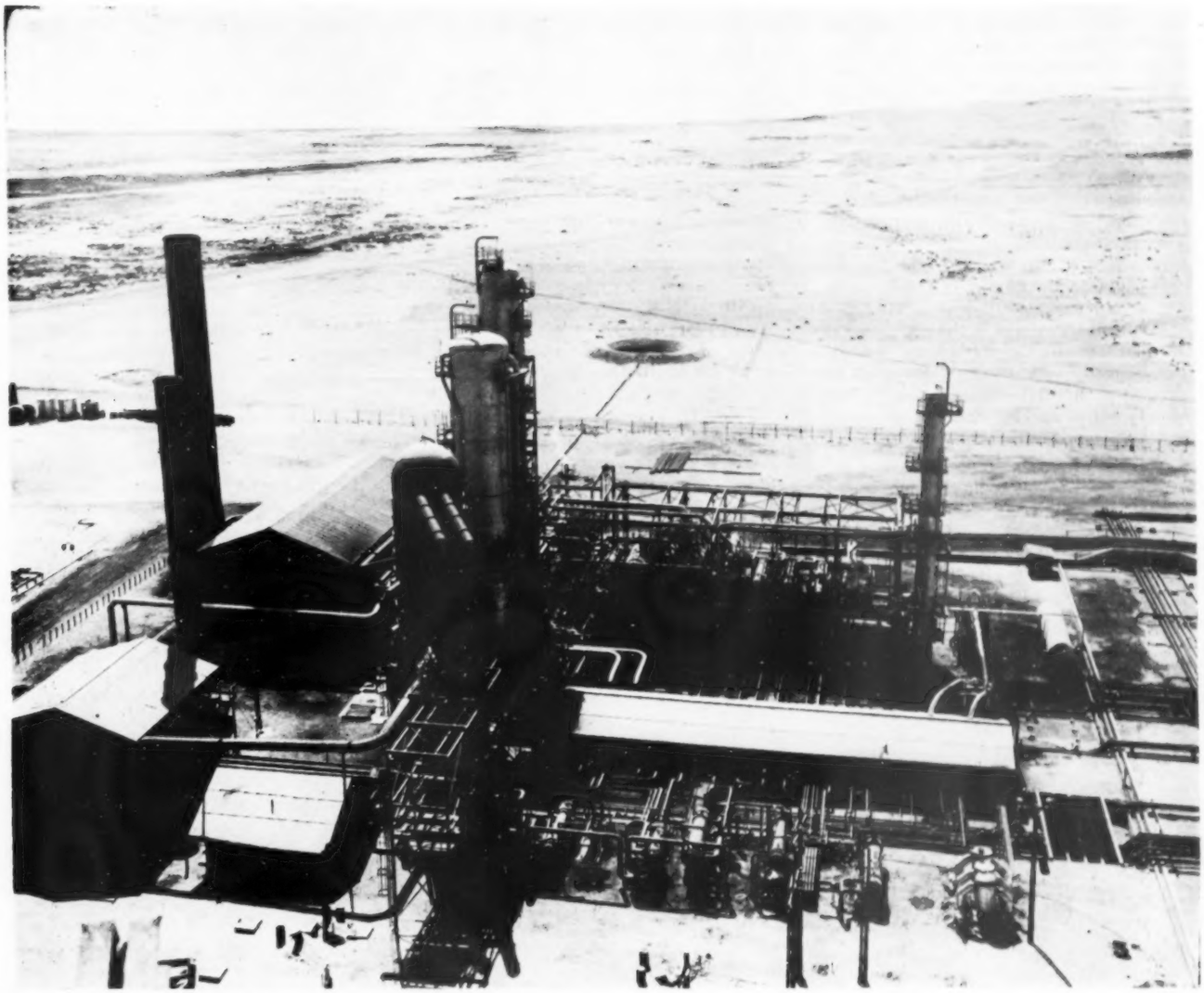
Gases from the cracking plants are treated in two California Research polymerization plants, using phosphoric acid on quartz, with a combined nominal output per day of 5,200 barrels of high octane polymers.

Three UOP thermal naphtha reforming units, of a combined capacity of 19,500 b/d for the production of high octane reformer stocks, are in operation.

Gas concentration and recovery equipment is installed to handle and recover the light ends from crude distillation and catalytic cracking, some of which is used as liquid butane.

ANALYSIS OF KUWAIT CRUDE

		Method of Test	Results
Gravity	°A.P.I.	Calculated	31.7
Spec. Grav.	60°F./60°F.	I.P.59/45	0.867
Dist. Test			
I.B.P.	°C.	I.P.24/44	49
Vol. at 50°C. (122°F.)	%	"	0.5
" " 75°C. (167°F.)	%	"	3.5
" " 100°C. (212°F.)	%	"	7.5
" " 125°C. (257°F.)	%	"	12
" " 150°C. (302°F.)	%	"	16.5
" " 175°C. (347°F.)	%	"	21
" " 200°C. (392°F.)	%	"	25.5
" " 225°C. (437°F.)	%	"	29.5
" " 250°C. (482°F.)	%	"	34
" " 275°C. (527°F.)	%	"	38.5
" " 300°C. (572°F.)	%	"	42.5
Total Dist.	Vol. %	"	43.5
Residue	"	"	55
Loss	"	"	1.5
Sp. Gr. of Dist.	60°F./60°F.	I.P.59/45	0.759
Sp. Gr. of Resi.		"	0.955
Sulfur Content	Wt. %	I.P.61/45	2.49
Visc. centistokes at	32°F.	I.P.71/47	42.5
" " "	70°F.	"	15.3
" " "	100°F.	"	8.5
H_2S (dissolved)	Wt. %	A.I.O.C.269/49 (mod.)	nil



Crude unit on Bahrain Island of Bahrain Petroleum Co. Ltd., Caltex affiliate.

Ancillary equipment includes naphtha acid treating plants, PbS gasoline and kerosine sweetening plants, an Edeleanu liquid sulfur dioxide plant for kerosine treatment, and also facilities for the manufacture of sulfuric acid, doctor solution and sodium sulfide.

For the production of blow asphalts, there is an air-blowing batch asphalt converter of a capacity of 75,000 long tons per annum, blown asphalt capacity.

A very efficient and modern plant for the manufacture of steel drums for all purposes is in operation.

The total tankage is approximately 8½ million barrels.

All steam and electric power is generated within the refinery, water for the boiler feed being processed in a tertiary water treating plant consisting of Zeo-Karb ion exchange followed by hot lime treatment and tertiary phosphate injection. The effluent is fed to evaporators, part of the steam being condensed for make up to the high pressure boilers.

Sea-water is used for cooling, and after passing through efficient API type separators, the clear effluent, free from oil, is discharged into the Persian Gulf.

Full fire-fighting and protection facilities are provided, including a ring fire main, chemical fire fighting equipment, steam hoses, etc.

The repair and maintenance department is equipped with machine shops, welding shop, meter and instrument shop, carpenter shop, electric shop, and tool room so that all major repair work can be carried out on the premises.

Apart from local deliveries, essentially all of the refinery production is loaded from the marine loading terminal at Sitra Island (which is connected to Bahrain Island by a short bridge and by a longer causeway and bridge to the wharves). At the wharves are six berths, all of them equipped for handling ocean-going vessels.

Loading of finished products to tankers is from tankage at the loading terminal, by pumps also located at the terminal and through a network of manifolded lines, ranging from six to 20 inches in diameter, the loading rates ranging from 3,000 to 16,000 b/hr.

The total number of employees at Bahrain is approximately 8,000, about 80 percent of whom are Bahraini nationals. Housing is supplied to most non-nationals or housing allowances are made. In a few cases, nationals are supplied with houses. Air-conditioning is provided in most of the houses and in hospitals and offices. Hospitals and health services are provided for all em-

ployees, and schools for the children of all classes of employees. Canteens and domestic stores are available for certain classes of non-nationals, and recreational facilities are provided for all classes of employees.

The company maintains roads, communications, services and amenities, and mention must be made of the gardens and layout of the whole place, which have been most artistically carried out. The housekeeping of the company's premises is on the whole of the highest order and would be a credit to any organization wherever it was located.

The refinery of the Kuwait Oil Co. at Mina-al-Ahmadi has a crude oil distillation capacity of 30,000 b/d taking off 45 percent of distillates from Kuwait crude of which the general analysis is shown in the accompanying table.

The crude oil distillation unit is of Badger design, with an original design capacity of 25,000 b/d. With the addition of extra pumps, heat interchangers, etc., the capacity has been raised to 30,000 b/d.

This topping plant takes off about 45 percent by weight of distillate, a motor spirit overhead with a final boiling point of 165-175°C, a kerosine side stream, and a gas oil side stream with about 53.5 percent of fuel residue of a specific gravity of about 0.955. This residue, with portions of the gas oil side stream, is used for blending various grades of fuel oil for diesels and bunkers for ships calling at Mina-al-Ahmadi, which is the primary purpose of the refinery. When required, the plant is run to give a lighter residue of about 60 percent with a Redwood No. 1 viscosity of 1,400 secs at 100°F.

The overhead gasoline, with an end point of 165-175°C, is part fractionated and stabilized, and after doctor sweetening and leading to 70-75 octane number is used to supply the local market.

Sulfur in the crude is mainly concentrated in the heavy fraction, so the kerosine is quite sweet, water white and color stable and requires no chemical or clay treatment. The gas oil is also water white with a satisfactory cetane number.

Fuel for the distillation unit is oil gas for the radiant side and roof tubes, which are of carbon steel, with oil heating for the convection bank. With a transfer temperature of 290-295°C, the formation of H_2S in the heater is negligible and does not materially increase the H_2S content in the crude oil.

Originally, caustic soda solution was injected into the crude for protection of the plant against H_2S corrosion, but difficulties were encountered in its use, and now an emulsion of caustic soda and ammonium sulfate is used which is found to be quite satisfactory.

Sea water is used for cooling and fire services, and at first condenser tube failure gave some trouble. These original tubes were of the following composition:

Copper	71 Percent
Tin	1.1 Percent
Arsenic	0.04 Percent
Zinc	to 100 Percent

These have been replaced by cupro-nickel 70-30 tubes to get over this difficulty.

Magnesium blocks are used in cathodic protection of the M. S. tubes. A small asphalt plant, consisting of two boiler stills working continuously under vacuum with excess steam, has been installed for the manufacture of bitumen for local use on the company's and state's roads, the distillates from which are used for fuel blending.

The Iraq Petroleum Co. refinery at Tripoli (Lebanon), with a capacity of 10,500 b/d, has a somewhat checkered history. The first unit was built by the "Free French" in 1940 out of any material which could be found or fabricated on the spot, and had an original capacity of 1,750 b/d. Later it was modified by the French, and when taken over by the company in 1945, had a capacity of 4,200 b/d, which was later raised to 4,900 b/d, and later again reverted to 4,200 b/d.

To increase the throughput in 1948, a further unit was designed and built locally having a capacity of 6,300 b/d.

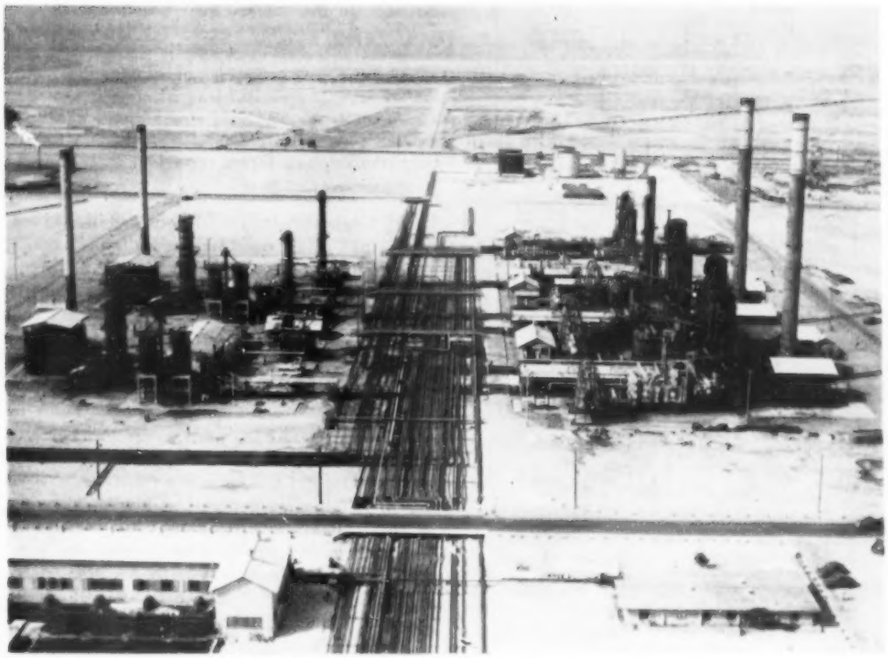
General view of Consolidated Refineries Ltd. at Haifa, Israel, which is operating at a low rate.

Therefore, at present there are two distillation units with a total capacity of 10,500 b/d, the products from which are all consumed in Syria and Lebanon, but are not quite sufficient to satisfy requirements, the remainder being imported.

These distillation units produce overhead gasoline, kerosine and gas oil side streams and a fuel residue as follows:

	Weight Percent
Gasoline	22
Kerosine	12.5
Gas Oil	17.5
Residue Fuel	46.5
Loss	1.5

The gasoline, with an end point of



Arabian American Oil Company's 189,000-barrel refinery at Ras Tanura, Saudi Arabia. The plant processed an average of 170,000 b/d in 1952.

165° C, after stabilization is doctor sweetened and then leaded with 2 cc TEL per gallon to give a finished motor fuel of 65 O.N. The kerosine is finished by doctor treatment, and the gas oil is salt filtered.

The plant is situated close to the Tripoli terminal of the Iraq Oil Co.'s 12 and 16-inch pipe line system.

The tank farm of the terminal is situated on high ground on the shore side of the refinery. Installed are seven 15,500-bbl. and 27 12,000-bbl. welded tanks with floating roofs. Feed to the refinery and loading terminals is by gravity, the pressure at the shore and manifold station being about 60 lbs., giving tanker loading rates of 800 to 1,500 tons per hour.

There are four loading lines and berths, with a depth of about 50 feet of water at each berth. The loading lines lie on the bed of the sea. At the loading end, buoyed rubber hoses are connected to the lines, and to these the tanker loading lines are connected.

The refinery has 30,000 tons tankage for finished products, 10,000 tons gasoline, 2,500 tons kerosine, 2,500 tons gas oil and the rest bunkers and fuel storage.

Khanaquin Oil Co.'s refinery at El Awand, which is operated for the Iraq Government, obtains its oil from the Naft Khana oilfield, part of which is located in Iraq and part in Persia. The border line between the two countries, which was fixed after the 1st World War, passes practically through the center of this field, which is at present being produced both by the Persians and the Khanaquin Oil Co. Two wells are producing on the Iraq side and from what one could see, two were also being produced on the Persian side.

There are two conventional topping plants in the refinery, one of Foster-Wheeler design with a capacity of about 3,800 b/d, and a Badger type unit of about 6,800 b/d capacity, giving an overall capacity of 10,500 b/d.

The crude oil has a specific gravity of 0.816-0.817, and is of mixed base containing about 0.66 percent wax, and with an aromatic content of about 12 percent. Distillation gives the following yields:

Gasoline	20 Percent
Kerosine	20 Percent
Gas Oil up to	10 Percent as required
Fuel Residue	48.5 Percent

Gasoline treatment consists of acid and soda washing, solutizer treatment, and leading with 2.5-2.6 cc TEL per gallon. Kerosine is acid and soda treated, and gas oil sold as distilled. There is a Simon-Carves contact plant with a capacity of 7.5 tons of oleum per day for the manufacture of sulfuric acid for the gasoline and kerosine treating plants.

Deliveries from the plant are mainly in cans and rail cars, about 32,000 gallons per day being filled in cans and 36,000 gallons in tank cars to various agent and filling stations. The cans are made at the plant, the can factory having a capacity of 1,800,000 cans per month. This can factory is of modern design and a very high quality can is turned out.

The imported staff for the refinery is housed on the site, and is provided with club and recreational facilities of various kinds. The quarters for the nationals staff house about 85 of artisan type and 20 of junior type who are also provided with recreational facilities.

The Consolidated Refineries Ltd., Haifa, Israel, plant is working at under one fourth of its four million tons per annum capacity. In 1952, 843,000 tons of imported oil was processed for local consumption.

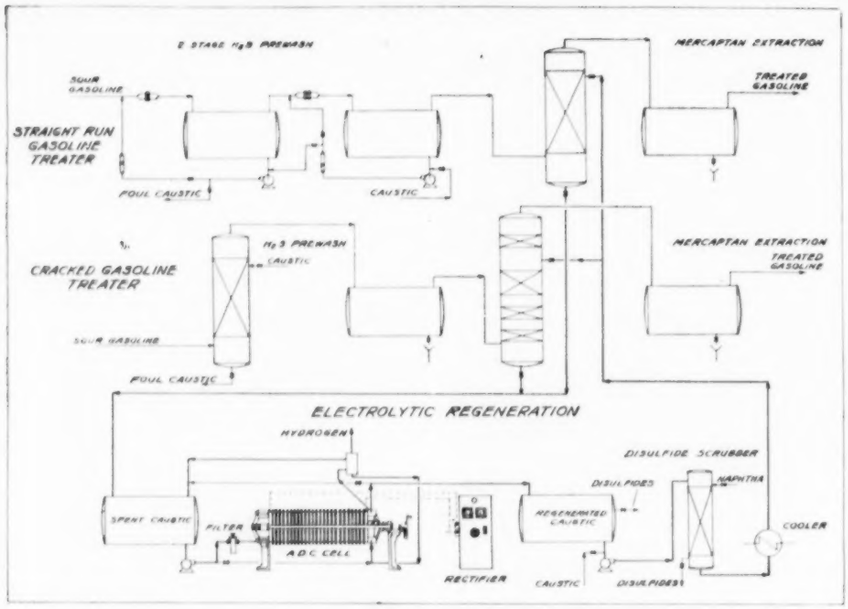
There are three topping units, which are being run alternately for short periods in order to maintain them in good working condition. Two stabilizing plants, one re-run unit and three chemical refining plants are in operation. The products being manufactured are gasoline, gas oil, diesel oil and light and heavy fuel oils.

The total refining capacity of these Middle East refineries therefore stands at present at about 16 and a half million tons per annum.

Work commenced in the latter part of 1952 on the new five million tons per annum refinery which the Anglo-Iranian Oil Co is building at Aden, and which is due for completion early in 1955.

Another refinery of the same capacity as the Aden one is envisaged, but no decision has as yet been made regarding its construction.

These refineries, together with the new Baghdad refinery now being built, would raise Middle East refining capacity a further 11.2 million tons per annum.



Flow diagram of the ADC electrolytic regeneration process of treating spent solutions. In this method sour gasoline is caustic washed and the mercaptans extracted. Subsequently, the spent caustic is passed through an electric cell which gives virtually complete regeneration and long life to the treating solution. The final step of the process is the extraction of residual disulfide by naphtha washing before re-cycling regeneration.

The economics of gasoline treatment

By Charles W. Rippie
Vice President
American Development Corporation

Dr. Charles Rippie, vice president of American Development Company, is well known in the petroleum refining industry for his work in the chemical treatment of distillate stocks. He has had extensive experience with major oil and chemical companies and has contributed largely to the literature in his field.

IT HAS long been recognized that sulfur left in gasoline causes some lead salts in deposits to promote pre-ignition in present high compression automotive engines. Within the past 60 days, one large motor car producer has decreased the engine compression ratio to avoid the use of super premium gasoline required after the first six to eight thousand miles of operation. Pre-ignition of available competitive gasolines made this reduction necessary, but should not be construed to indicate any change in policy to increase compression ratios.

At the recent American Petroleum Institute Meetings, duPont Company men[1] discussed pre-ignition in automotive engines which can be inhibited by additives.

At the same time, Shell Oil Company announced a new scavenging agent of lead deposits to improve pre-ignition of the fuel.

Improved catalytic cracking and catalytic reforming refining processes have tended to increase octane numbers and to decrease the relative amounts of treating chemicals required to meet suitable sales specifications.

Recently a duPont Company chemist investigated a sulfur-tetraethyl-lead interaction in motor fuels[2] and reported appreciable high losses of tetraethyl-lead efficiency by sulfur compounds. Ethyl Corporation's study on road effectiveness of tetraethyl-lead as influenced by added sulfur[3] is an outstanding valuable report on the actual economic losses of tetraethyl-lead caused by sulfur compounds in motor fuel. Their conclusion was that the average laboratory tetraethyl-lead efficiency was 46 percent when 0.01 to 0.12 percent sulfur was added to 11 commercial gasolines with an average sulfur content of 0.09 weight percent.

The economic loss of tetraethyl-lead is thus brought out in sharp contrast by this Ethyl paper in comparing mercaptan sulfur converting processes to mercaptan sulfur extracting processes when one millimeter of tetraethyl-lead per gallon costs about $100 per thousand barrels of gasoline. Under the above average conditions, sulfur compounds cause appreciable economic losses in present commercial fuels.

Treating processes currently employed by the oil refining industry may be divided into converting and desulfurizing processes as follows:

CONVERTING PROCESSES

1. Doctor and hypochlorite
2. Copper salts
3. Sulfuric acid
4. Caustic, air, temperature
5. Inhibitor treatment.

DESULFURIZATION PROCESSES

1. Caustic soda extraction
2. Caustic soda and organic solvents
3. Catalytic vapor phase

It is apparent that typical converting mercaptan sulfur to disulfide sulfur processes do not remove any sulfur and hence cost more tetraethyl-lead compared to desulfurized similar gasolines. Sweetening gasoline by any method using air and elevated temperature causes the loss of a minimum of 20 gallons of gasoline per thousand cubic feet of air used. Usually any heated alkaline solution increases inhibitor requirements of the treated product.

The vapor phase catalytic processes require higher capital, maintenance, and operating costs than liquid phase desulfurizing processes as a general rule.

The Gray, Perco, Union, Houdry, Gulf, Anglo-Iranian and Shell vapor phase processes reduce high total sulfur stocks to improve some physical or chemical property of the treated product.

Recently a number of liquid phase desulfurizing processes have been developed with the increased use of catalytic cracking processes. Caustic extraction[4], Unisol Solutizer[5], Tannin Solutizer[6] and ADC (American Development Company) electric regeneration of spent treating solutions[7] are liquid phase desulfurizing processes which remove mercaptan sulfur from the treated stocks. Caustic extraction

was the earliest process of removing mercaptan sulfur and to regenerate the spent treating solution at elevated temperature with or without the use of oxygen-containing gas. The Unisol, or caustic-methanol process, improved extraction of mercaptan sulfur, especially straight run gasolines, but the high overall regenerating costs have limited its general use in the industry.

The Solutizer process added various organic chemicals to strong alkaline solutions and improved mercaptan extraction from cracked stocks compared with caustic extraction. The Tannin Solutizer processes permitted regeneration of the spent solutizer solution at lower steam temperature or air at some elevated temperature.

The ADC electric regeneration requires no heat to oxidize the mercaptan sulfur compounds to disulfide sulfur independent of the type of mercaptans present. At the present time the ADC process is the only available commercial liquid process extracting mercaptan sulfur and regenerating spent treating solution at gasoline stream temperatures. Commercial ADC operation on thermal cracked gasoline permits lower inhibitor costs than the former caustic steam regenerative process. Several ADC units are now being installed in domestic and foreign treating plants after careful evaluation with all competitive processes.

Recent United States patents cover current developments on conversion and desulfurizing distillate treating processes:

CONVERSION

2,550,905—Solutizer, alkali, air, and elevated temperature.
2,616,831—Inhibitor, alkali, air.
2,621,147—Elevated temperature and time.

DESULFURIZATION

2,149,379—Isobutyrate Hydrofluoric acid.
2,525,813—Anhydrous.
2,534,382—Furfural.
2,413,945—Tannin Regeneration.
2,516,877—Nickel oxide and hydrogen in vapor phase.
2,623,007—Metallic catalyst in vapor phase.

Some of the limitations of inhibitor sweetening are discussed in an excellent paper[8] which explains why many sour gasolines do not sweeten due to the fact that inhibitors react with primary mercaptans only.

In summary, the refiner bases the economic evaluation of the treating process on the lowest overall cost of the treated product to meet sales demands.

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[5]Yabroff, Ind. Eng. Chem. 32,257 (1940).
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[8]Rosenwald, Petroleum Processing, September 1951.

Hydrogen desulfurization processes

TWO PROCESSES employing hydrogen for the treatment of petroleum distillates were reported to the industry at the recent mid-year meeting of the API refining division. One is a development by Shell and the other by Anglo-Iranian Oil Co. Both employ a cobalt-molybdenum-alumina catalyst to obtain the desired reaction.

Shortly before the API meeting, Universal Oil Products Co. had announced the first commercial operation of its Platreater process at the Roosevelt Oil & Refining Co. plant in Michigan. The Platreater employs a platinum bearing catalyst to hydrogenate olefins and remove sulfur compounds from a petrochemical by-product stream containing olefins, but rich in aromatics. Primary purpose of the Platreater is hydrogenation of the olefins to paraffins so that the aromatics may more readily be removed in a Udex unit. Presence of olefins limits the effectiveness of the Udex separation. Hydrogen from a Platformer is used in the Platreater.

Elsewhere in this issue is an article describing the application of hydrofining at a German hydrogenation plant processing heavy petroleum residual oils and liquefied coal. The German process is employed for sulfur removal of aromatics concentrates containing benzene, toluene and xylenes. Water gas is used to provide hydrogen for the process.

This issue also publishes an article by Dr. C. W. Rippie discussing current processes employed by the industry in the removal of sulfur from light distillates, particlarly gasoline. In gasoline treating, the removal of sulfur is now recognized as being of primary importance because of the effect removal has on lead susceptibility. Conversion by sweetening of sulfur compounds to a less objectionable form does not permit maximum increase in octane value through the addition of TEL.

In the case of kerosine, the removal of sulfur improves the odor and reduces char value. The importance of sulfur removal from diesel fuel has been intensified in recent years by the large volumes of sour Middle East crudes processed in the Eastern Hemisphere and by increased use of West Texas and other sour U.S. crudes. Cracking tends to concentrate sulfur in cycle stocks to levels around three percent. Such percentages adversely affect engine cleanliness and wear.

Hydrogen desulfurization methods have been known for some time, but process development has been retarded by the high cost of hydrogen. Recently the development of catalytic reforming processes has removed this objection. Very large quantities of hydrogen will be available in the near future as new reformers come on stream.

Anglo-Iranian Oil Co. developed its Autofining process in the course of an extensive research for a method of removing undesirable quantities of sulfur from petroleum distillates boiling above 392°F without using outside hydrogen. A description of the process was given at the API meeting in a paper written by F. W. B. Porter of the company's research installations at Sudbury-on-Thames, England.

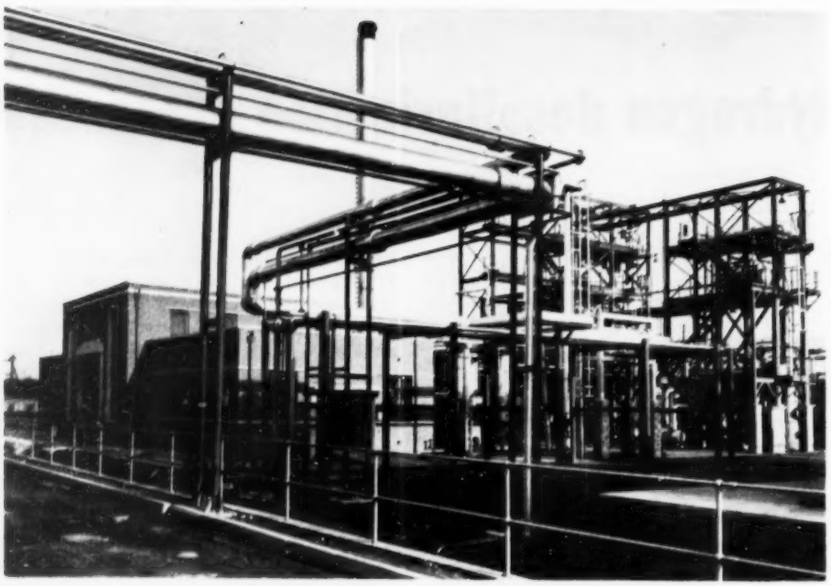
Kerosine and diesel fuel which make up the usual unit charge do not lend themselves to methods generally employed in the treatment of gasoline. Hydrofining was known to be a successful method, but the process requires a low cost source of hydrogen for successful application. The AIOC research developed a process which requires no outside source of hydrogen and hence was named Autofining as a contraction of auto hydrofining.

Hydrogen for desulfurization is obtained by the dehydrogenation of naphthenes in the sulfur-bearing distillates. With effective catalysts developed for desulfurization, it was found that sulfur could be removed at hydrogen partial pressures low enough to permit the dehydrogenation step to be taken efficiently. Result is a process operating at temperatures above 660°F to facilitate dehydrogenation and pressures below 250 psi to avoid an excessive hydrogen partial pressure.

The AIOC Autofining process is in commercial operation at Llandarcy, Wales. Results of pilot plant investigation were reported previously (WORLD PETROLEUM, June 1952, pg. 62).

A full year of operating results now are available from the 3,500 b/d Llandarcy Autofining unit which went on stream last July. Charging sour naphtha and tractor fuel kerosine, the unit has reduced sulfur content of naphtha from 0.143 to 0.003 weight percent, kerosine from 0.27 to 0.004 and tractor fuel from 0.645 to 0.106 weight percent.

The unit operates at 100 psig with a reactor temperature of 780°F. Catalyst is regenerated in the unit with steam-air or inert-air gas mixtures. Regenera-



Autofiner unit now in commercial operation at Llandarcy, Wales, refinery of Anglo-Iranian Oil Co.

tion at about 1,000 hours is required on light distillate operation, but may be required at 200-400 hours when diesel fuel is being processed.

An accompanying flow diagram indicates major steps in the Autofining process. Feed stock and hydrogen-rich recycle gas are separately heated to reaction temperature before charging to the reactor. Flow through the reactor is downward and out to a waste heat boiler for steam generation and thence to a knock-out tower for removal of about two percent of heavy ends. This step eliminates a subsequent rerunning of product. Overhead from the knock-out is cooled before entering a separator from which recycle gas is withdrawn. Liquid is flashed to a stabilizer for H_2S removal and correction of flash point. A light caustic wash is given to guard against faulty stabilizer operation.

In studying process variables, it was found that the effect of temperatures on desulfurization is not great, but that maximum dehydrogenation of naphthenes is attained at around 780°F and 100 psig at reasonable space velocities. About 99 percent desulfurization of naphtha and kerosine is attained at a space velocity of three volumes of oil per volume of catalyst per hour.

Investment cost of the 3,500 b/d Llandarcy unit within battery limits was $700,000 of which materials, engineering, and contractor's fees totaled $550,000.

Utilities required at this unit on full operation are:

150-lbs steam	5,000 bbl/hr. (net)
Cooling water	573 bbl/hr.
Fuel	25 mm Btu/hr.
Electric power	10 KW

In contrast with other approaches to the problem, Shell has developed a hydrodesulfurization process which operates at higher pressures and employs a trickle technique. A wide variety of stocks may be handled. The technique tends to keep investment in equipment low. A commercial unit now is building at Shell's refinery at Stanlow, England which will have a straight run gas oil charge capacity of 10,000 b/d. Cost of the unit exclusive of process and engineering design is estimated at $930,000. A plant of similar capacity designed to process Middle East cycle gas oil would cost about $1,300,000.

The commercial unit was designed as the result of research at the Royal Dutch/Shell laboratory at Amsterdam, Holland. Description was given at the API mid-year meeting by H. Hoog of the laboratory staff, and H. G. Klinkert and A. Schaafsma of the Bataafsche Petroleum Maatschappij, The Hague.

In the Shell technique, as described by the authors, feed stock is trickled in liquid form over fixed beds of solid catalyst. Hydrogen recycle rate is low, running about 1,350 cubic feet per barrel of charge when running cracked cycle oil. Space velocity is 1.6 volumes per volume per hour. Preferred pressures range from 600 to 750 psia and temperature from 690 to 720°F.

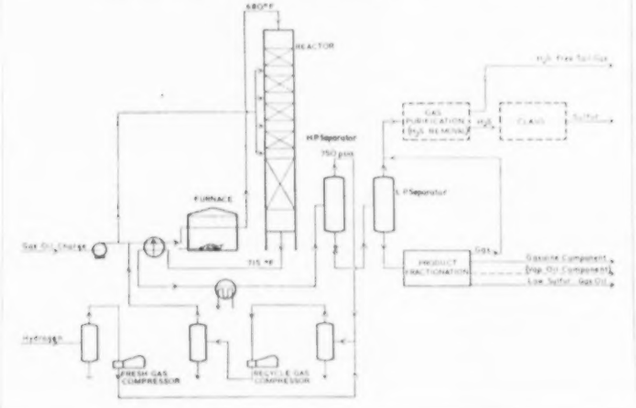
Flexibility of the Shell process is increased because feed stocks are not vaporized at the pressures employed. Operating in the liquid phase, it has been found possible to desulfurize high boiling distillates without large volumes of recycle gas. Sulfur is not removed from the recycle gas.

An accompanying flow diagram suggests major process features. Compressed recycle hydrogen with makeup hydrogen is mixed with part of the raw liquid charge, preheated by exchange and in a fired heater before entering the top of a multi-bed reactor at about 680°F.

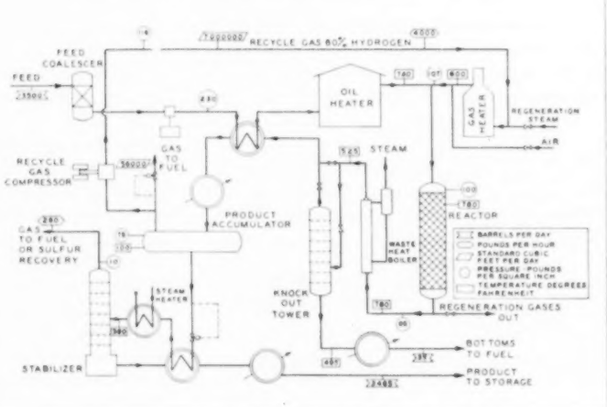
The hydrogenation reaction is exothermic and control through the reactor is obtained by injecting part of the cold, raw charge between each of the catalyst

(Please turn to page 177)

Flow diagram of Shell Hydrodesulfurization process.



Flow diagram of Anglo-Iranian Autofining process.



Hydrofining treats aromatic stocks from German hydrogenation works

Petroleum industry researchers are devoting increasing attention to the utilization of hydrogen in sulfur removal and for the hydrogenation of heavy stocks. The accompanying article by Doctor Stahmer describes how one hydrofining process in Germany is being employed in the desulfurization of aromatic concentrates. A somewhat similar application recently was made in the United States. Development of hydrogen utilization processes is particularly timely in view of the growing volume of this gas being produced as a by-product of catalytic reforming. At the recent mid-year meeting of the A.P.I. refining division, two additional methods of treating with hydrogen were described: Shell's trickle Hydrodesulfurization process and the Anglo-Iranian Oil Company's Autofining process.

By Alfred M. Stahmer

A SURPLUS of residual fuel in Germany resulting from recent increases in over-all refining capacity has caused four important hydrogenation works to convert their operations from coal to fuel. One of these plants, Scholven-Chemie A.G., a state-owned company, has developed a new method of benzene refining at Gelsenkirchen-Buer in the Ruhr area.

The new hydrofining method is employed as a substitute for sulfuric acid treating of aromatics produced in the hydrogenation works. The method vastly improves quality and reduces losses.

During World War II the requirements for pure benzene and its homologues had increased sharply. Benzene was used not only for the production of high octane motor fuel, but was also applied in the chemical industry as solvent and as feed stock for manufacturing dyestuffs, plastics and products for the textile industry. Toluene was used for the production of TNT explosives. Practically sulfur-free pure benzene was necessary for the production of plastics on styrene basis.

Through the application of the hydrofining process for purifying the raw benzene, the yield of entirely sulfur-free raffinate is 98-98.2 percent. At present, many coking works in the Ruhr area supply the produced raw benzene to the hydrogenation works at Scholven for further processing. The capacity of the Scholven works (18-20,000 tons of raw benzene per month) allows the processing of 75 percent of the raw benzene output of associated Ruhr mining companies, i.e. BV-Aral Aktiengesellschaft.

The purpose of the purification of the raw benzene is the removal of the sulfur, oxygen and nitrogen containing compounds, e.g. thiophenes, carbon disulfide, mercaptans, phenols, nitriles, and cyclic oxygen-nitrogen compounds as well as of the unstable compounds (cyclopentadiene, indene, cumarone, etc.). As early as 1924, the Badische Anilin & Soda-Fabrik, Ludwigshafen, carried out tests in order to use their experience in the hydrogenation process for the refining of raw benzene. The results of this research work are the basis of German Patent No. 550,-123 of September 16, 1925. In the description of this patent it is said that "raw benzene is treated at high temperature under pressure, if necessary under high pressures, in presence of catalysts which are not susceptible to sulfur with hydrogen, hydrogen containing- or hydrogen-supplying gases in such a manner that the benzene itself is not changed or or only to a small extent."

Despite further tests at Ludwigshafen in 1931 and 1934, which were carried out together with Benzolverband and had good results, the tests were not made on plant scale.

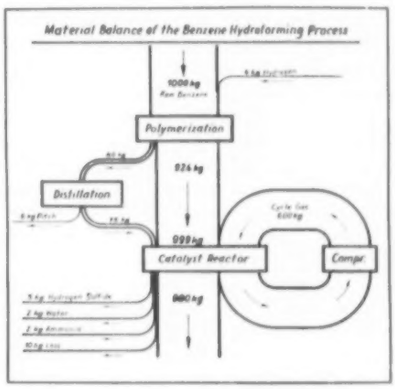
Under the difficult conditions after World War II, hydrogenation plants had to find new ways of manufacturing. The change in marketing conditions and quality requirements caused commercial tests of the method to be undertaken.

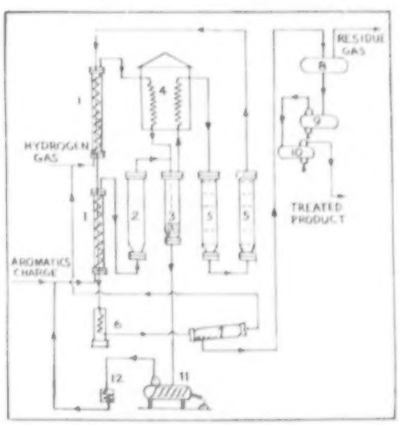
The high pressure hydrogenation process in Germany uses coal or heavy oils as feed stock principally in two stages: in the primary sump phase with suspended catalysts and in the second gas phase with catalysts which are fixed in the high pressure reactor. In the sump phase there occurs, as a primary reaction, cracking combined with hydrogenation of the higher molecular compounds, whereby the feed stock is converted into gasoline and middle oil. In the gas phase the benzination of the middle oil and the refining to finished products which contain carbon and hydrogen only is completed. The sulfur, nitrogen and oxygen compounds are converted into hydrogen-sulfide, ammonia and water.

In the sump phase the reactions are rather slightly influenced by the kind of catalyst used, but in the gas phase the quality of the catalyst determines how the reactions will proceed. According to the catalyst, temperature, pressure, reaction time and hydrogen concentration, isomerization of the paraffins, stage-wise saturation of the olefins, hydrogenation of the aromatics and the complete removal of traces of sulfur, nitrogen and oxygen compounds are possible. There were also found reaction conditions which produce aromatics from hydro-aromatics and other naphthenes respectively. Due to the importance of aromatics for high octane motor fuels, this process has been developed during recent years more and more completely and in the United States benzene and its homologues are produced from petroleum.

The high level of the high pressure hydrogenation would not be possible if M. Pier had not found sulfur-resistant catalysts which are indispensable in view of the always present sulfur content of feed and intermediate products of the high pressure hydrogenation.

Contrary to the acid treatment of the raw benzene which is carried out in liquid phase, hydrofining is carried out in gas phase, whereby the raw benzene is carried through the catalyst together with coke oven gas containing about 50 percent hydrogen or with pure hydrogen under suitable temperature and flow rate in order to maintain the structure of benzene and its homologues unchanged. All other evaporated compounds, however, are completely hydrogenated and the contaminating elements such as sulfur, nitrogen and oxygen are removed by reduction.





Flow scheme of benzene hydrofining process.

The raw benzene coming from the coke oven contains small amounts of highly unsaturated compounds, especially cyclopentadiene, indene, cumarone, and their derivatives. In heating the raw benzene together with hydrogen up to reaction temperature, these highly unsaturated compounds polymerize and lead to plugging of the heat exchanger tubes and preheater tubes. In the previous BASF pilot plant experiments, this difficulty was successfully overcome by using a prehydrogenation stage at about 220-240°C. Instead of this procedure, Scholven chose the opposite method of intentionally polymerizing the highly unsaturated compounds at about 200°C, then removing the polymers and further heating the feedstock, now free of polymers and polymerizing substances, up to reaction temperature.

At Scholven-Chemie AG. the first hydrofining unit with a capacity of 7,000 tons per month was started in November 1950. The unit works satisfactorily. The hydrofined benzene was so pure that pure benzene, pure toluene and pure xylene were obtained by simple fractional distillation. On account of these results, the unit was expanded to a capacity of 12,000 tons per month starting in May 1951. A further expansion of this unit to a throughput of 18-20,000 tons per month is planned.

The procedure of benzene hydrofining is shown in the accompanying flow diagram. "Fresh gas", i.e. hydrogen from a Linde or water gas unit and feedstock (95 percent distilling at 180°C) from the coking works are separately heated in heat exchangers to about 200° at a pressure of 70-80 atmospheres. The preheated mixture then enters the polymerization stage. The reactor is large enough to allow an adequate reaction time. Fresh gas heated to about 350°C is mixed with the product from the polymerization reactor and discharged into an evaporator where practically the whole feedstock is evaporated and transported by the hot hydrogen into the catalyst reactors.

Non-evaporated polymers are released from the bottom of the evaporator as sludge. In a separate distillation unit this sludge is concentrated to pitch. The recovered distillates are re-cycled into the process.

The gas phase from the evaporator, together with the hydrogen, is heated to about 350°C in a following second heater system and led into the catalyst reactors. There, in the presence of catalysts, the sulfur compounds are converted to hydrogen sulfide, the oxygen components to water and the nitrogen components to ammonia and the respective pure hydrocarbons. The unsaturated hydrocarbons (i.e. the cyclopentadienes) are completely hydrogenated as far as they are not removed as polymers in the sludge of the polymerization stage. The main compounds (benzene and homologues) pass the catalyst reactors unchanged. The reaction products are cooled in heat exchangers and coolers.

The liquefied benzene components are separated from the surplus gas in a separator and the separated gas is recycled into the process through gas circulating pumps. Fresh gas is steadily added, since not only must the consumed gas be replaced, but also a part of the gas must be continually discharged on account of the methane and nitrogen in the fresh gas. The discharged gases are used to heat the pipe heaters and for the distillation of the sludge. The refined benzene is freed from the main quantity of hydrogen sulfide by heating a stabilizing column and from the last traces of hydrogen sulfide in the following caustic and water wash.

Originally zinc-magnesium-molybdenum catalyst was applied, but Scholven uses molybdenum oxide on alumina. This catalyst can, if necessary, be regenerated *in situ* by burning coke deposits with oxygen containing gases.

Total hydrogen consumption is about 38 to 40 cubic meters per ton of feedstock. Of this, about 25 cubic meters is required for saturation of olefins, 10-11 cubic meters for sulfur removal, and two cubic meters for oxygen and nitrogen removal. Losses run from seven to 10 cubic meters per ton of feed.

A comparison of quality and yields by hydrofining as compared with sulfuric acid treatment is shown in Table I.

In refining with sulfuric acid the feed stock cannot be acid-treated immediately due to the increase of unstable compounds in the higher boiling fractions which form sulfonates or sludge when treated with sulfuric acid. Therefore, these higher boiling hydrocarbons, which are susceptible to sulfuric acid treatment, must be removed by a preceding distillation which removes about five percent from the feed stock. Final yield by sulfuric acid treatment is 90 to 85 percent because two percent is removed by sludge formation and about eight percent by sulfonation. The boiling range of the acid raffinate is changed, as can be seen from Table I. By the catalytic hydrofining process, however, the total feed stock is converted into hydrofined raffinate with a 98 percent yield which, by comparison with the feed stock, shows an increase of the heavy benzene fraction.

Particularly remarkable is the fact that the catalytically hydrofined product has a non-aromatic content of only two percent, which consists almost entirely of prerun and heavy ends. The important benzene and toluene fractions are entirely free of non-aromatics.

In the sulfuric acid treatment, sulfur compounds such as carbon disulfide and thiophene are little changed, whereas the hydrofined raffinate is practically sulfur-free due to the hydrogenation of sulfur compounds to hydrogen sulfide. Oxygen compounds such as cumarone and phenol (about two percent) are reduced to pure hydrocarbons and nitrogen compounds, i.e. pyridine, nitrile and ammonia.

Detailed economic investigations have proved that the hydrofining process cannot compete with sulfuric acid treatment with throughputs of 100-2,500 tons per month. The smallest plant capacity which works economically is about 4,000 to 5,000 tons throughput per month. In such a plant the manufacturing costs are not considerably higher than those of the acid treatment. In Germany it has been found that the 10-20 percent greater yield of the hydrofining process takes care of the cost of closing down small sulfuric acid plants and shipping raw feed to a central hydrofiner.

In summary, it may be said:

1. In the hydrofining process a feed stock of 95 percent at 180°C distilling with final boiling point 200-210°C can be charged directly and yields a raffinate of 98 weight percent.

2. A pre-treatment in order to remove hydrogen sulfide, pyridine and phenol is not necessary.

3. The finished product from the hydrofining process is practically free of sulfur.

4. It is not necessary to distill the finished product of the hydrofining process. It can be used as motor fuel without being distilled after hydrofining.

5. The main components of the finished product can be rendered quite pure by simple fractionation only.

6. The finished product has a higher content of xylene and heavy benzene.

7. The heavy benzene from the hydrofining process is water-white, has a mild odor and has no tendency to go off color. It is a stable aromatic solvent.

8. Sole by-product of the hydrofining process is about 0.5 percent polymer pitch. It has a softening point of over 100°C. It is an ashless pitch which is a favorite technical product, but for the manufacturers of cumarone resin, this pitch is no substitute.

9. As compared with sulfuric acid treatment, the hydrofining process is continuous. It does however, require considerably higher investment.

TABLE I

QUALITY OF PRODUCTS, COMPARISON OF YIELDS

	Feedstock	Benzene refined with sulfuric acid (66° Be)	Hydrofined benzene
Specific gravity	0.884	0.879	0.877
Sulfur contents % wt.	0.45	0.35	0.001
Acid wash color	200-500	1.7	0.10-0.13
Bromine value g/100 ml	30	0.38	0.035
Distillation			
Prerun up to 79.5°C	3% wt.	—% wt.	2.5% wt.
Benzene fraction up to 81°C	65% "	62% "	65.0% "
Toluene fraction up to 112°C	15% "	14% "	15.0% "
Xylene fraction up to 145°C	5% "	4% "	5.0% "
Solvent Benzene up to 180°C	7% "	5% "	9.0% "
Scrubber oil compounds over 180°C	5% "	— "	1.5% "
Yields	100% "	85% "	98.0% "

RESEARCH FOR SINCLAIR-BAKER CATALYTIC REFORMING

By J. W. Teter* and L. E. Olson**

SINCLAIR Research Laboratories, Inc. and Baker and Company, Inc. have designed and developed a new reforming catalyst, RD-150. The Sinclair Refining Company has announced the utilization of this catalyst in the design of a 16,000 b/d catalytic reformer.[1, 2] C. F. Braun and Company is contractor for this unit, which will be constructed at Sinclair's refinery in Marcus Hook, Pennsylvania. Initial operation is scheduled for September 1954.

The catalyst is now produced in Baker's Newark, New Jersey plant, and new facilities are being erected to meet commercial requirements. The M. W. Kellogg Company is offering the RD-150 catalyst for fixed-bed units with or without regeneration.

The description of the research which produced RD-150 catalyst is typical and can be given only in a general way at this time. Specific solutions to the several problems which were encountered and overcome with the catalyst and process will be omitted until patent coverage is completed. However, the general story presents the objectives, catalytic tools, analytical methods and describes the experimental reforming units and the general reforming results. Industrial research cannot be described adequately without illustrating the cooperation, communication and coordination which is necessary between research teams. This is demonstrated by citing the groups as they participated in the several phases of the project.

Production of a catalyst which could be regenerated was our primary objective. Operation of a platinum catalyst "continuously" and applying infrequent regeneration was desirable in order to obtain maximum selectivity and productivity of barrel-octanes of reformate per pound of catalyst. After exploratory work on aromatic synthesis it was evident that aromatic production could be maximized at low pressures, and although continuous operation can be achieved with select stocks of high naphthenic content, the more paraffinic stocks increase the catalyst fouling rate, especially at conditions which maximize aromatics. Therefore, a catalyst which can be regenerated would permit the most economic operation for high severity reforming with paraffinic stocks and for the production of aromatics.

Our work indicated that a good reforming catalyst should cyclize paraffins to aromatics in order to yield the maximum barrel-octanes from a variety of naphthas, rather than hydrocrack to propane and lighter gas, and produce isoparaffins. Therefore, one objective became the design of a catalyst which would maximize dehydrocyclization and minimize hydrocracking.

The continually growing demand for higher octane motor gasoline indicates that the reforming process for the future should produce the maximum yield of C_5+ reformate up through 95 clear research octane quality. Obviously, this aim and the planned production of aromatic hydrocarbons for chemicals are compatible with our objective to maximize cyclization.

Individual hypotheses are abundant in any research community, especially in the early exploratory stages of a process. It is also true that many of our preliminary hypotheses could not withstand critical experimental scrutiny. However, the two general ideas did stand up. First, we believed that the nature of the catalyst support would influence selectivity, resistance to temporary poisons, and resistance to irreversible aging. Second, we thought that several significant theoretical considerations indicated that the dispersion of the active catalytic agent would control hydrocracking, enhance naphthene isomerization-dehydrogenation, maximize dehydrocyclization and influence poisoning and aging resistance. Though these were simple hypotheses, their pursuit and experimental attack by inorganic, organic and physical chemists led to a mutilation of many theories—and to a better type of catalyst!

Catalyst preparation equipment pictured in Figures 1 to 5 was used up through small pilot scale. Pilot plant work done by Baker extended the laboratory work as mentioned below.

Earlier work had established that systematic structural or architectonic characterization was necessary to promote the continuing design of new catalysts. Furthermore, the complete physical description of the catalysts facilitated the satisfactory reproduction of batches both in the laboratory and the pilot plant. Industrial catalytic chemists appreciate that the chemical and physical-chemical tools which *may* characterize a catalyst are almost useless unless these properties are correlated with other experiments that demonstrate such properties as the selec-

[1] "Platt's Oilgram" *31*, #78, p. 3 (April 22, 1953).
[2] *The Oil and Gas Journal 51*, #51, p. 131 (April 27, 1953).

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**Senior Project Chemist, Catalysis Research Division, Sinclair Research Laboratories, Inc., Harvey, Ill.

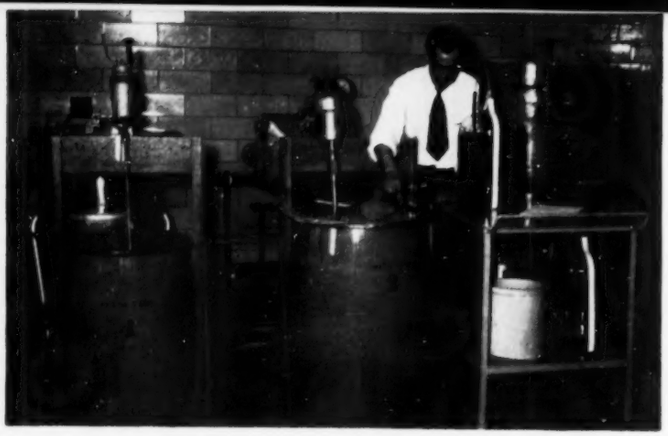

Figure 1. Catalyst precipitation and washing tanks.

Figure 2. Forced circulation drier.

Figure 3. Laboratory model filter press.

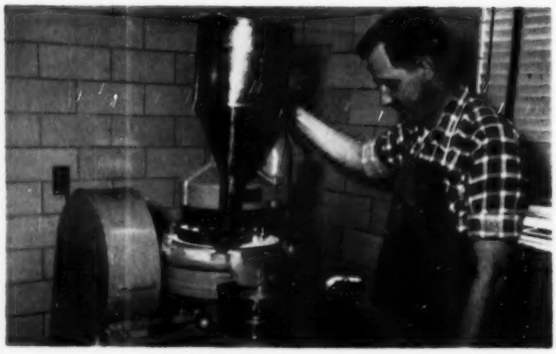

Figure 4. Rotary tabletting machine.

tivity and aging resistance of the catalyst under investigation. We believe chemical characterization alone is quite inadequate.

Several physical tools were employed. Certain methods had been developed during earlier work and some techniques were modified for the immediate purposes. X-ray, spectrometric and fluorescence units were used in the characterization of the support, and more recently a new technique has been developed for the rapid determination of surface areas.[3] Total "nitrogen areas" were determined by the well known BET method and the same high vacuum adsorption units were used to obtain a complete description of porosity.[4] Catalysts were also "fingerprinted" by thermal analyses and electron microscopic examination. Permeability studies were correlated with effectiveness factor work conducted in the bench-scale processing units.

In general, the obvious chemical studies were "tied in" with catalytic and physical properties in order to elucidate and control the several steps of the catalyst preparation from the initial formulation to the finished catalyst. As stated above, publication of details must await patent protection.

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[3]R. A. Van Nordstrand and K. M. Hack, "Small Angle X-Ray Scattering of Alumina and Silica Gels." Paper presented Chicago Catalysis Club, Spring 1953 Meeting. To be published.

[4]H. E. Ries, Jr., R. A. Van Nordstrand, M. F. L. Johnson and H. O. Bauermeister, *J. Am. Chem. Soc., 67*, 1242 (1945).

Figure 5. Catalyst calcination furnace.

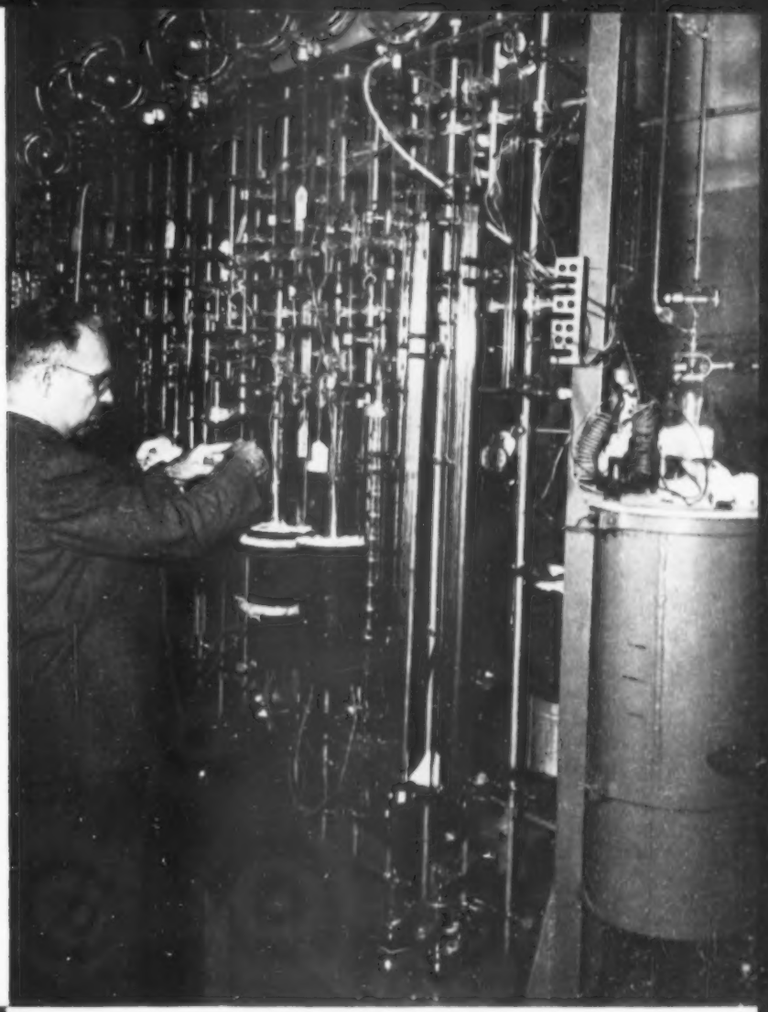


Figure 6. High vacuum adsorption apparatus for study of surface properties of catalysts.

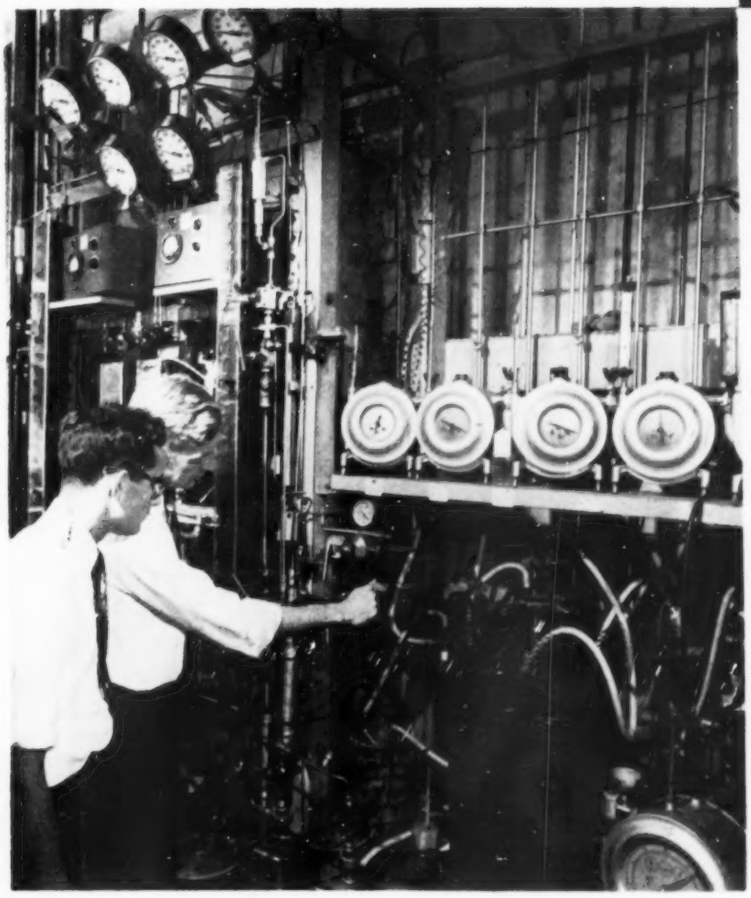


Figure 7. Close-up view of bench scale aging units.

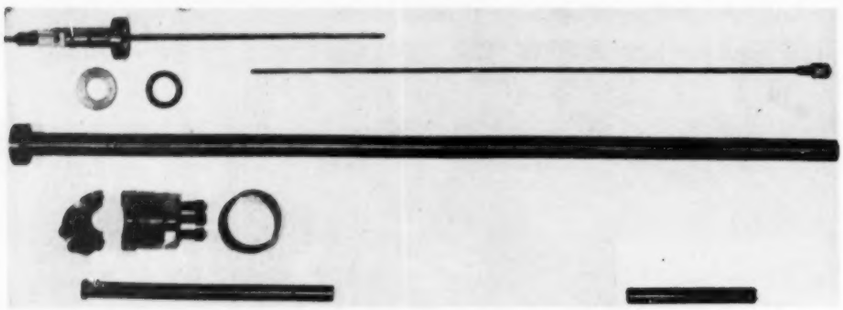


Figure 8. Dismantled bench scale reactor.

Several units of the physical equipment are employed for this research, notably the X-ray and electron microscope. One tool, the high vacuum adsorption apparatus, is pictured in Figure 6.

After initial development of the laboratory catalysts and the bench-scale reforming units described below, cooperative research was joined with Baker and Co. Selection of the precious metal type of catalysts has been based on the regenerative properties, superior aromatic synthesis and improved yield-octane results which had been obtained. Therefore, the cooperative program was mutually attractive. Baker's research and development work was directed by E. F. Rosenblatt.

Baker's contributions are important. For example, the recovery of platinum metal is well established and assured. The RD-150 catalyst has been reproduced quite satisfactorily, and this required attention to details of the stepwise preparation and reproduction of physical properties. Catalysts produced on the pilot plant scale have equaled laboratory preparations as established by runs in the aging units described in the next section. Laboratory techniques were converted to feasible production methods suitable for commercial scale manufacture of the catalyst. Baker and Co. will contract to manufacture RD-150 and recover the precious metal value in a modern plant being constructed near Newark.

Early in the catalyst development program it was recognized that catalyst life is an important economic factor and that aging rates could only be determined by reforming runs. An aging unit which could be operated over a wide range of controlled and reproducible conditions was essential. It was desirable that these aging units should also be suitable for yield-octane studies on various naphthas, and that the quantities of catalyst required for test work should be held as low as possible to facilitate catalyst preparation.

Since catalyst life studies are by their nature and purpose time-consuming, it seemed essential that the aging units be set up in multiple banks, and that the operation be made as automatic as possible in order that operating expense be held to a minimum. The use of catalyst charges in the order of 25-50 ml. total volume demanded accurate naphtha and process gas flow control. Products recovery, both liquid reformate and net gas make from the process, should be nearly quantitative if yield and product distribution studies were to be significant. Although once-through hydrogen flow would serve in units designed for short-term activity tests, it was desirable to incorporate process gas recycle into the catalyst life-testing unit since commercial units would require gas recycle.

The effect of temperature on the numerous reactions involved in the reforming process was known to be important, hence close control of this variable was necessary. Although a commercial unit would operate as a multi-bed adiabatic system with reheats of the processing stream between reactors, such a system would be difficult to duplicate in a small reactor. Hence it was decided to operate the bench scale units as iso-thermal reactors, and depend on the operation of an adiabatic pilot plant for data which could be correlated with the bench scale results. Finally, the life study units must be dependable. Stoppage of gas recycle or loss of pressure, for example, was known to cause rapid coking and loss of activity under the severe operating conditions desirable in a life test unit.

A catalysis research group, working in close cooperation with the departmental engineering staff, designed the units which have satisfactorily met the restrictions imposed. The units were set up in banks of four each, each bank requiring the attention of one operator per shift. Figure 7 shows a typical bench-scale aging unit.

The major variables of naphtha feed rate, process temperature, pressure control, and liquid product release are controlled by appropriate instrumentation. Gas recycle on each unit is maintained by a reciprocating pump which acts through an intermediate glycerine-filled pressure surge vessel and a check valve system on the gas line. Circulation rates are measured by means of a liquid displacement de-

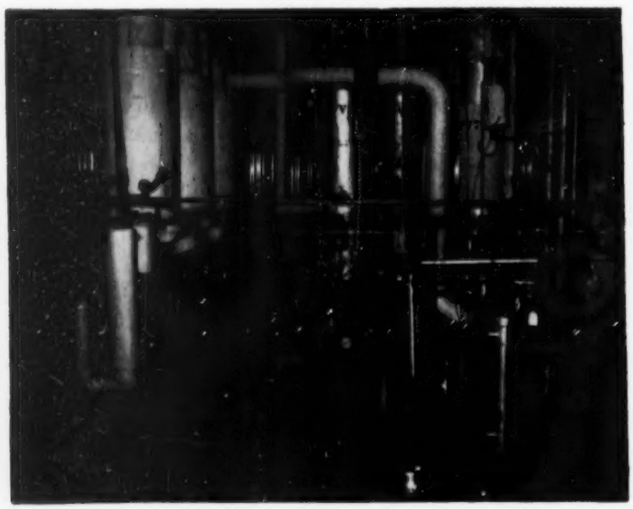


Figure 9. Adiabatic pilot plant.

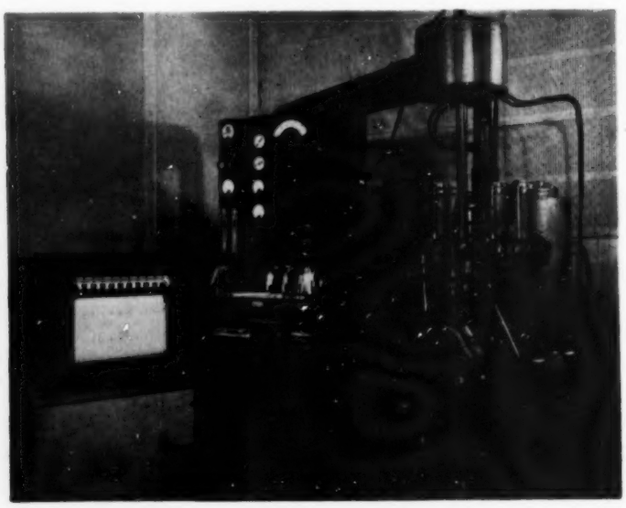


Figure 10. CFR engine modified for Micro-Octane test.

vice into which the gas flow may be diverted by closing one valve in the recycle line.

A view of the components of a reactor is shown in Figure 8.

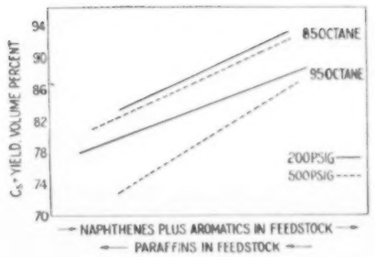
Typically, a charge consists of 25 ml. of catalyst, diluted tenfold with inert tabular alumina. The dilution is not uniform, but is arranged so that the feed contacts a progressively increasing ratio of catalyst to diluent as it moves downflow through the bed. In this manner the endothermic reaction is distributed uniformly along the tube with a resulting very close approach to the desired isothermal conditions in the catalyst zone.

Each reactor unit is protected by an alarm system which warns the operator of either high temperatures or low pressure, either of which requires immediate attention. In normal practice hourly readings on each unit are sufficient for maintenance of proper operating conditions and the recording of necessary experimental data.

A test program on a catalyst or feedstock may require a run of several hundred hours. For convenience, each 12-hour period is treated as a single test. Liquid product and gas samples are taken for appropriate analyses, and product weight balances calculated on the basis of these test periods. In a long run, it is considered sufficient to make a complete weight balanced product distribution study at about weekly intervals; daily octane number and gas make data are recorded as a guide in operations. Considering the small quantities of feed and product handled in one of these tests, the typical overall product recovery of 97 to 100 weight percent has proven quite satisfactory.

Pilot plant studies on the RD-150 catalyst and reforming process development were carried out in two stages. Early in the project, a two bed adiabatic pilot plant was designed, constructed and operated for a period of several months. Data from this test work correlated well with that being obtained on the multiple unit isothermal reactor systems described above. Hence, the pilot plant was shut down and held in stand-by condition until the project had reached the stage for commercial unit design. The pilot plant was then revised to include an additional reactor and to incorporate other features of the projected refining installation. Figure 9 is a view of this latter plant during the final stages of revision. Operation of the pilot plant is continuing in order to confirm developments made in the catalyst and processing since the early runs. A secondary aim of the operation is to obtain sufficient reformate for thorough road testing in the company test car fleet.

Considerable progress in hydrocarbon analysis has been made during the last several years; however, even incomplete analyses of typical mixtures of hydrocarbon types in naphtha fractions are time-consuming. Quantitative rate studies were necessary to guide the preparation of catalysts which could minimize dehydrocyclization of paraffins to aromatics simultaneously with isomerization-dehydrogenation of naphthenes comprised of both C_5 and C_6 rings. Therefore, early research was conducted with pure hydrocarbons.



GENERAL EFFECT OF FEEDSTOCK COMPOSITION ON YIELD-OCTANE RELATIONSHIP FOR CONTINUOUS AND REGENERATIVE OPERATION

Figure 11.

As an example of isomerization-dehydrogenation, methyl-cyclopentane and cyclohexane can be converted to benzene in substantially theoretical yields. Dimethyl-cyclopentane isomers are converted quite efficiently to toluene.

Dehydrocyclization with the RD-150 catalyst has been well established by conversion of n-heptane and n-octane to toluene and xylenes. Examples demonstrating aromatic syntheses from C_6, C_7 and C_8 boiling range naphthas prepared from crudes of Venezuela, California and Mid-Continent origin also establish significant dehydrocyclization under commercially feasible conditions.

The rate of progress in a research project is often a function of the development of proper analytical tools and methods. The RD-150 development was no exception. In addition to the various physical chemical methods of catalyst characterization described earlier, analyses were routinely made for contaminants which were suspected of affecting catalyst performance. Feedstock and product analyses for hydrocarbon types were run on myriad samples. Methods of analysis for the determination of trace quantities of impurities in naphthas were also developed. The availability of a distillation laboratory with equipment capable of making precise fractionations of hydrocarbons in quantities ranging from a few milliliters to drum lots was of great assistance.

The determination of product octane numbers, particularly in the case of the bench-scale units, furnishes an excellent example of the utility of a well-designed test procedure. In each weight-balanced aging test, and in all yield-octane and process variable studies, it was necessary to debutanize the liquid reformate on laboratory fractionation columns for the determination of the C_5+ yields. The debutanized reformate would then be run on a modified CFR engine for neat and leaded Research Method octane number, and in many cases, the corresponding Motor Method octane numbers. In the conventional ASTM test procedure this would require 400 ml. of the stabilized product for each rating.

As a part of their work on fuel testing, the Engine Laboratory developed "micro-octane" methods. By these methods, involving the use of CFR engines with modified carburetor systems and instrumentation as shown in Figure 10, octane numbers of satisfactory precision may be obtained with from 30 to 60 ml. of fuel per rating. The approximately tenfold factor of sample size alone was of great benefit in that short test runs in the bench-scale units were made feasible. Furthermore, octanes may be run by the "micro" method in approximately one-half of the time required for the standard determination. As a general rule, from 20 to 25 micro-octane numbers could be run in an 8-hour shift.

Other instrumental methods of analysis of feedstocks and products were of great assistance. All hydrocarbon gas samples were routinely analyzed by mass spectrometer for constituents through the C_5 range. The use of the ultra-violet and infra-red spectrometers for hydrocarbon analysis was of particular value in studies of aromatics synthesis.

The yields of reformate obtained by continuous and regenerative processing of various naphthas over RD - 150 catalyst are a function of octane level, operating pressure and feedstock quality as shown in simplified form in Figure 11.

Several generalizations may be made by inspection of the curves in this figure. It is apparent that at any operating pressure between the limits shown, as product octane levels are increased, the yields of reformate decrease. Moreover, the yield at any octane level depends to a great extent on the feedstock quality, as measured by the naphthene plus aromatic content, or inversely by the paraffin content. Highly paraffinic naphthas, such as those obtained from Middle East crudes, are thus less desirable as reform feedstocks than, for example, the highly naphthenic Coastal or California naphthas. The advantages of the lower pressure operation, necessarily with increasing frequency of regeneration, become apparent at the higher octane levels, especially with the more paraffinic naphthas. For example, when operating at 200 psig rather than 500 psig, a yield advantage of about six percent is achieved at 95 octane with paraffinic stocks. This important yield increment is a consequence of favoring the dehydrocyclization reaction at lower pressures. Although not shown in the figure, the lower pressure operation has an added benefit in that butane production is decreased, and also the stabilized reformate has a lower vapor pressure than at corresponding product octane levels with higher pressure operation. Thus, the permissible outside butane additions are increased when pressuring the reformate to motor fuel volatility with a consequent additional yield increment of final product.

Aerial view of Lavera oil port.

French operations 16.6 percent higher

By B. Pene

DURING the year which has just closed, French refineries have operated on an ascending scale. The tonnage treated in 1952 was 16.6 percent more than in 1951. As in the preceding year, production has exceeded the needs of France and its African territories; an important part of the finished products went into custom work for foreign account and to exports.

French refinery products in 1952 were disposed of as follows: domestic consumption, including bunkerage, 65 percent; North Africa and overseas territories, eight percent; custom work and export, 27 percent. A total of 157,973,600 barrels were treated by French refineries in 1952. In the same period the national production of crude oil was 3,131,100 barrels (2,050,000 barrels from Lacq), compared with 3,030,000 barrels in 1951. These tonnages represent only a small percentage of French needs. However, in this connection, note should be taken of important developments in oil exploration in France and its African possessions, and the adoption of favorable legislation intended to attract the necessary capital.

Petroleum imports in 1952 amounted to 155,982,000 barrels. The imports originated almost wholly in the Middle East, which contributed 91.7 percent compared with 90.2 percent in 1951. Of this total, 33,840,000 barrels were supplied by Compagnie Francaise des Petroles (CFP) as its share in Iraq Petroleum Co. in 1952. "French raws" (from CFP and national production) represented 26.9 percent of the tonnage treated by the national refineries for national requirements, compared with 16.2 percent in 1951. This tonnage is due to increase in line with Kirkuk, Qatar, and Zubair.

The funds for payments are indicated in the following table, which shows the percentage of crudes of different origins treated for French needs:

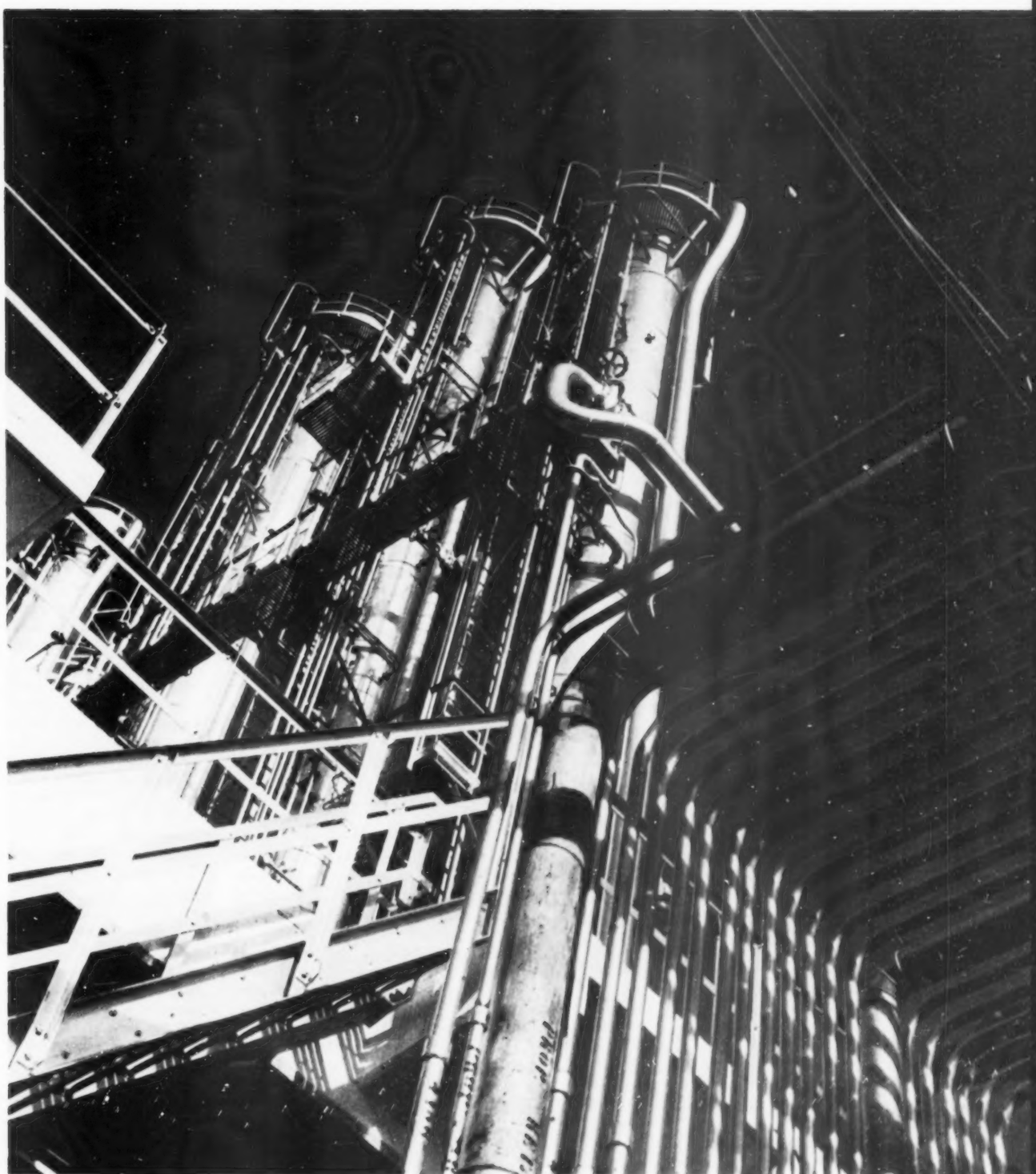
	PERCENT
National Crude	2.5
CFP Crude	24.4
Middle East payable in Francs (under agreements)	8.7
Dollar Source Crudes	24.4
Sterling Sources	40.0

Under agreements made two years ago, crude oil supplied by American companies from the Middle East have been paid for in francs in proportions varying from 25 to 40 percent (average about 30 percent). It is understood that the French government will try to raise the proportion to 40 percent.

In 1952 the tonnage transported by French ships was 54 percent of the total, compared with 40 percent in 1951 and 34 percent in 1949. This increase has resulted from putting new ships in service and the increase in tonnage of crude drawn from pipe line terminals at Mediterranean ports of the Middle East. It should also be mentioned that in 1952 51.1 million barrels of finished products, compared with 36.5 million barrels in 1951 (of which 12.4 million barrels were destined to North Africa and overseas territories), were exported. These operations have been an important source of exchange.

Imports of refined products have been continuously decreased. As in 1951, imports this year have consisted of 100/130 O.N. aviation gasoline, certain categories of lubricants and dopes, and small quantities of high octane motor fuel, paraffin and petroleum coke. Due to entry of new installations into service for the manufacture of lubricants, it is expected that in 1953 imports of the latter category will no longer be necessary. In the year 1942, consumption has shown a perceptible lag

Vacuum still for lube production at the Gonfreville refinery of Cie. Francaise de Raffinage.



Solvent rectifying columns at the Shell Saint-Gobain works, Petit Couronne.

from the rhythm of constant increase that has prevailed since the end of the war. The global increase over 1951 amounted to only seven percent. This increase has been mostly in gasoline and fuel oils, whereas sales of gas oils and heavy fuels, which depend directly on the general economic situation, have been stationary. Motor fuel and premium gasoline have shown an increase of 17 percent compared with 1951; premium gasoline itself amounted to 21 percent as against the previous 17 percent. Gas oil increased one percent.

As regards heavy fuels, the expected large increase in demand prophesied at this time last year has not been realized; consumption remained about what it was in 1951. On the other hand, consumption of lighter fuels increased 18 percent.

Consumption of lubricating oils decreased six percent. This decrease affected only industrial oils, while motor oils remained substantially the same.

The octane numbers of motor fuels have remained at about the same level as in 1951 (70 M.M.) for ordinary gasoline and between 80 and 87 for premium fuels, pure or in a ternary mixture of gasoline-alcohol-benzene. It is expected that when new catalytic cracking installations go into service there will be a new increase in octane numbers.

Among new installations is a second thermal reforming unit at the Petit-Couronne (Shell-Berre) refinery; a doubling of topping installations at the Pauillac refinery; installations for refining lubricating oils at Gonfreville (Compagnie Francaise de Raffinage), at Dunkirk Societe Generale des Huiles de Petrol, and Port Jerome (Esso-Standard); and improved means of access and utilities at Lavera (Etang de Berre) near Marseilles.

The principal projects remaining for completion include a number of catalytic cracking projects which are expected to go on stream in 1953. Details of these completions and projects, by refineries, follow.

At the Compagnie Francaise de Raffinage, Provence refinery, with a present crude oil capacity of 62,000 barrels per calendar day, the works to be completed this year are, principally: construction of an 11,000 b/d catalytic cracker with gas plant which will go on stream in July 1953, and completion of storage and transport installations at the Lavera oil port.

At the Berre refinery of Compagnie de Raffinage Shell-Berre, which now has a capacity of 71,000 b/d, the most notable recent development was completion in June of an 8,000 b/d catalytic cracker with its appurtenances. Along with this construction the company has proceeded with an extension of certain treating units, utilities and storage facilities. Also completed are installations for handling and storage at the Lavera oil port.

The first units for a chemical factory have been installed at St. Gobain, located near the Berre refinery and drawing its material from that refinery, and were put in service late in 1952. Among other products this factory will produce isopropyl alcohol, acetone and its derivatives.

At Shell's Petit-Couronne refinery (capacity 49,000 b/d) the existing installations have been remodeled.

Extensions at Shell's Pauillac refinery (capacity 16,500 b/d) have included construction of a new topper, a solutizer, an acid treating plant, new storage tanks, utilities and housing.

Societe Generale des Huiles de Petrole is building a Platforming unit at Dunkirk which will be finished about the end of 1954. Various port improvements and housing projects are underway.

Nearly all the works carried out at the Lavera refinery (present capacity 41,000 b/d) have consisted of remodeling and modernization of existing installations, also enlargement of storage facilities and construction of housing.

The plant of the Societe Naphtachimie, near to and supplied with material from the Lavera refinery, was put into operation at the beginning of 1953. This plant makes derivatives of ethylene and propylene, and particularly various solvents, glycols, etc.

The refinery of Esso-Standard at Port Jerome now has a capacity of 51,000 b/d. The principal works executed in 1952/53 comprise a 10,000 b/d catalytic cracking unit which will go on stream late in 1953, installation of a fourth steam boiler in the central power house, construction of two 4-tower blocks for air-cooling of circulating refinery waters, enlargement of storage (including one 7,920,000 gallon tank and one 3,640,000 gallon tank), and enlargement of administrative buildings, shops and workers' quarters. Construction has been begun on a third 25,000 b/d distillation unit which will be completed in the first half of 1954.

The Donges refinery of Raffineries Francaises de Petrole de L'Atlantique now has capacity for treating 32,000 b/d. An important unit recovering gas went into service the first half of 1953. Construction of an 11,000 b/d cracking unit is to be finished by the end of 1953. Various utilities and facilities, including housing, have been enlarged. A unit for producing cumene is underway, to be completed at the end of 1953.

Various improvements have been made by Raffineries de Petrole de la Gironde (Ambes) in existing units to bring the capacity to 18,500 b/d.

Installations at the Notre-Dame-de-Gravenchon plant of Socony-Vacuum Francaise (capacity 17,500 b/d) include a stabilizing unit (under way), installation of a new turbo-alternator group, improvement of existing units and services, housing and solutizer unit.

The Frontignan refinery now has a capacity of 25,500 b/d, a solutizer unit, and two new turbo-alternator groups have been added to the central power station. Other works include new transfer lines, remodeling of the laboratory, safety installations, and housing.

The Merkwiller refinery of Pechelbronn SAEM, which has a capacity of 1,700 b/d, treats mostly Alsatian crudes. Work in 1952/53 has been limited to maintenance.

Among the projects which have been mentioned, emphasis could be placed on the petrochemical plants which produce chemicals from ethylene and propylene furnished by adjacent refineries.

The Naphtachimie plant adjoins the Lavera (Etang de Berre) refinery and is designed to process 60,000 tons of naphtha a year received from the refinery and produce 10,000 tons of acetone, 17,000 tons of solvents and various chemical products, along with 21,000 tons of high octane gasoline. This plant will begin operating in 1953.

The Shell-Saint-Gobain plant located near the Berre refinery processes propylene furnished by the refinery to make acetone and its derivatives and began operation in January 1953. Its capacity is 7,500 tons of acetone and 3,000 tons of methyl isobutyl ketone. Other products are produced on demand.

Compagnie Francaise de Raffinage-Rhone-Poulenc will produce 10,000 to 12,000 tons of acetone a year from propylene in the refinery gases. The propylene unit of the La Mede (Etang de Berre) plant was finished in September 1952. Construction of the Rhone-Poulenc plant was begun in 1952 and is expected to be finished by the end of 1953.

Raffineries Francaises de Petrole de L'Atlantique Progil-Electrochimie is erecting a plant at Donges to manufacture cumene (isopropyl benzene) which is expected to begin operation by the end of 1953. The Societe Progil-Electrochimie is building a plant to treat the cumene produced at Donges to make phenol and acetone. It also will begin operation by the end of 1953.

Societe Industrielle des Derives de l'Acetylene (SIDA) at La Chambre (Savoie) made 5,700 tons of acetone and 900 tons of acetone derivatives from imported isopropanol in 1952.

The installations mentioned above will soon attain production as follows:

Acetone and derivatives	25 to 30,000 tons
Other Solvents	10 to 12,000 tons
Phenol	15 to 18,000 tons

For these tonnages there will be used petroleum gas (propylene, butylene) in the amount of 20,000 to 25,000 tons and about 70,000 tons of naphtha.

Detergents also are an important new product of French petrochemical plants.

Shell-Saint-Gobain is operating a Teepol detergent plant adjoining the Petit-Couronne (Seine Inferieure) which is expected ultimately to have a capacity of 25,000 tons a year. It began in July 1951 and in 1952 made 18,500 tons.

In 1951, capacity of the Standard Kuhlmann plant at l'Estaque (Bouches du Rhone) plant attained 4,800 tons of aryl-

The Dunkirk refinery of Societie Generale des Huiles de Petrole B.P. now has a lubricant producing capacity of 55,000 tons per year.

alkyl corresponding to about 16,000 tons of detergent. In 1952, 2,000 tons of arylalkyl were produced.

In 1952 Compagnie Francaise de Raffinage furnished to l'Industrie Chimique 2,600 tons of "chemical kerosine" for the preparation of detergents.

Fertilizer also is being produced by French petrochemical plants.

The Regie Autonome des Petroles is supplying natural gas for the manufacture of ammonia to the following three plants: ONIA Toulouse; Produits Azotes du Lannemezan; and Phosphates Tunisiens. A total of 18,487,000 cubic feet were delivered under this arrangement in 1952.

The Societe Industrielle de Derives de l'Acetylene (SIDA) has established a plant at Toulouse for the production of hydrocyanic acid from natural gas (capacity 600 tons a year).

To complete this rapid survey, mention may be made of projects designed to make the Lavera oil port (Etang de Berre) accessible to ships drawing 36 feet of water. It is expected that these works will be finished by the end of 1953. Finally, on April 2 of this year, the first consignment of gasoline from the Basse-Seine refineries was transported over the Le Havre-Paris pipe line, which has since been in regular operation.

TABLE I

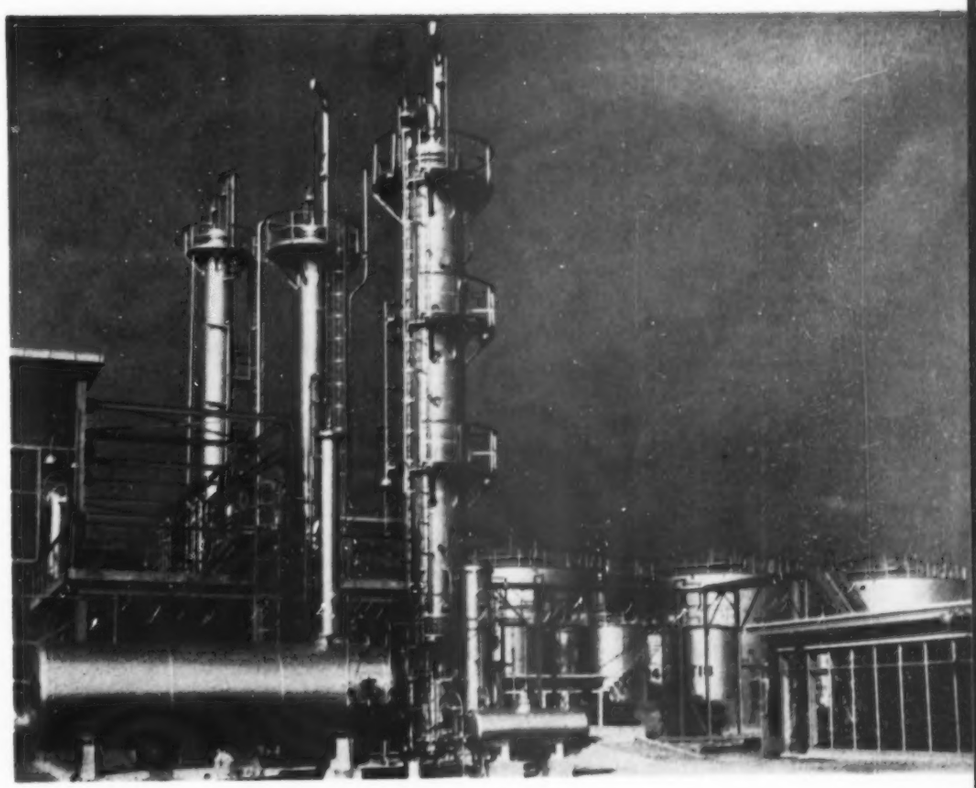
CRUDE RECEIVED BY FRENCH REFINERIES IN 1952

	Barrels	Percent
Middle East		
French participation	33,839,400	21.2
Other Origins	112,094,850	70.5
Western Hemisphere		
U.S.A.	610,050	0.4
Venezuela	9,084,500	5.7
Other Origins	352,800	0.2
National Production	3,131,100	2.0
	159,112,800	100.0

TABLE II

1952 REFINERY OUTPUT IN FRANCE

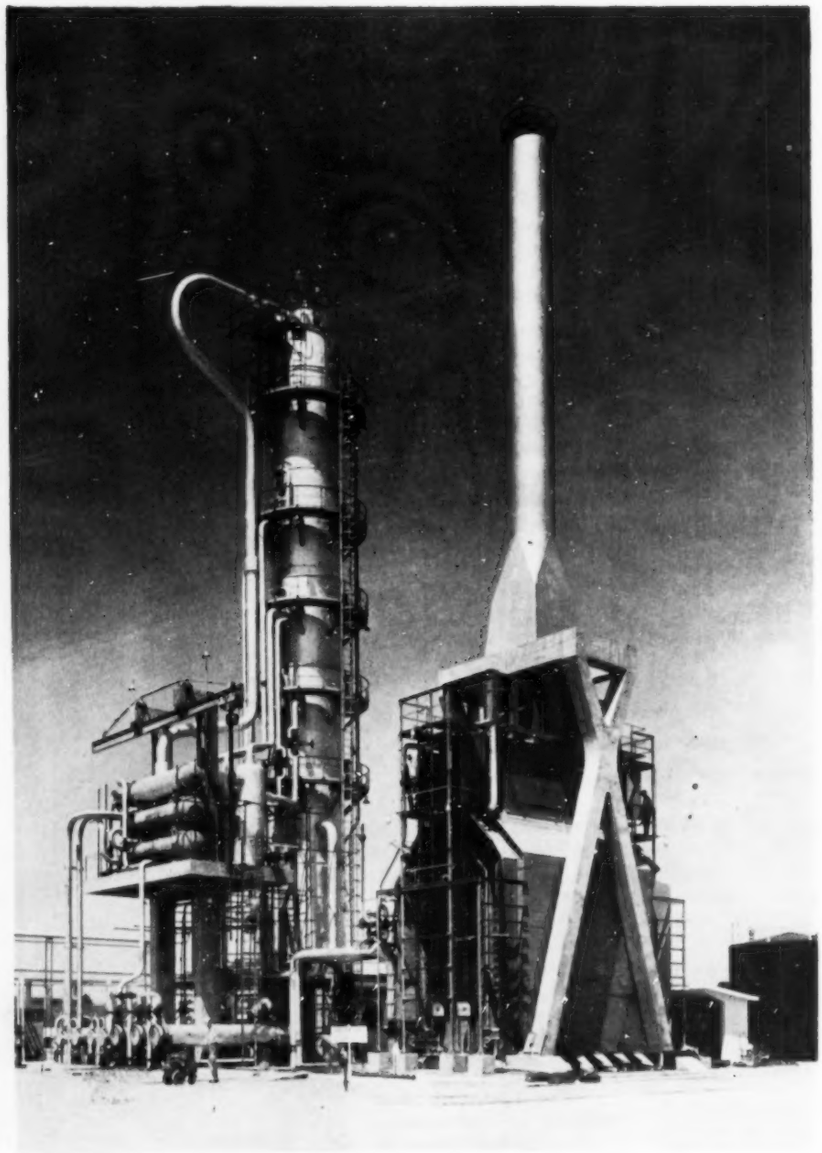
Propane	40,500 Metric tons
Butane	221,700 " "
Gasoline	40,777,000 Barrels
White Spirit	372,600 "
Diesel Fuel	1,082,400 "
Lamp oil	3,298,000 "
Gas Oil (Total)	35,565,000 "
Heavy Fuel (Total)	55,743,600 "
Lubricants	2,295,000 "
Bitumens	745,600 Metric tons
Paraffins	11,660 " "
Petrolatum	1,740 " "
Various distillates & by products	437,250 Barrels



Teepol detergent plant adjacent to the Shell refinery at Petit Couronne.

Italian gasoline quality and volume higher

Topping unit at the 15,000 b/d SAROM refinery near Ravenna.



By Alberto Girelli

CRUDE capacity of the Italian refining industry is still going upward, though it now is almost double the effective 1952 products consumption of the country. The impressive figure of 17 million metric tons per year (about 330,000 b/d) will represent Italian crude capacity at the end of the current year, and this figure is going to be increased very shortly to a new record of 23 million metric tons, as new plants and expansion of existing facilities for a total added capacity of six million metric tons are planned for 1954.

Refineries which are not yet on stream are planning to expand their production, and several applications for new construction are still in course of examination by the Commission of Ministry of Industry and Commerce in Rome.

Meanwhile, the internal market is getting overloaded, and the forecasts for expanded exportation are not very bright, as almost every country in the Mediterranean area is going to have its own refining industry, and big plants are under construction or planned in Asia and Africa. The internal consumption of finished products increased very sharply, but at a rate which will not avoid an overproduction crisis in the near future. The petroleum industry in Italy is therefore facing a new and important problem: how and where to sell its products.

To sell more products in a competitive market, refineries have improved their plants. Topping and chemical treating of light distillates used to predominate in Italian refineries in the immediate postwar years. Gasoline was then rationed, everything smelling like petroleum could be marketed with a sure profit, and the car owner used, without much arguing, a 60 octane gasoline and sometimes something worse. At the present, the majority of refineries are equipped with cracking or reforming plants.

With the increase of production, oc-

General view of Italy's new 100 million cubic foot natural gasoline plant built by AGIP which produces 200 tons of motor fuel and 130 tons of LPGas per day.

LPGas storage at the Cortemaggiore gasoline plant.

tane rating was set by specification at 65 motor method, and after a while at 70 MM, and is at the present at an average 74-76 MM for regular grade, and at 85 or more (Research O.N.) for premium grade.

In the present octane race, small refiners fear they are in danger of being put out of business owing to the technical deficiencies of existing units, and to the expensiveness of upgrading processes built in small scale units.

The problem has been solved, at least for the present, by lowering end boiling point of straight run gasoline, by increasing TEL addition to the maximum allowed by specifications, and through low cost bauxite desulfurization plants. Motor gasoline of 70 motor octane is obtained through bauxite desulfurization of 150-160° C end point straight run distillate from Arabian crudes, after 0.4-0.5 ml/l TEL addition.

Sixteen bauxite desulfurization units have been built during 1949-1951 for small and medium sized refineries by refinery staffs or by local equipment contractors. Natural bauxites available in Italy, though not comparable with American "Cyclocel" and "Porocel" grades, showed sufficient activity and efficiency for the relatively low-temperature conditions prevailing in desulfurization of low-boiling straight run cuts containing easily removable mercaptan and aliphatic sulfide sulfur.

The availability of better motor fuel encouraged car builders to increase compression ratios of new cars: Fiat, Lancia, and Alfa Romeo put on the market new models of average cars, during the years from 1951 to 1953, with compression ratios around 7-7.5 (6-6.5 was the previous average for similar models). For the new models the bigger companies started the production of "premium" gasoline (from their existing cracking and thermal reforming plants) of research octane around 79. Price to the consumer for "premium" grade is not much higher than for regular, mainly owing to the great share of government tax over both types of fuels (about 70 percent of the sale price), and car owners appreciated the difference in engine performance and in mileage. Small and medium size refineries, with a real spirit of competition, tried to keep the pace through blending Middle East with Venezuelan distillate of higher octane value, switched from bauxite desulfurization to bauxite reforming, and finally entered catalytic cracking. The TCC catalytic process has been pioneered in Italy by the independent company Permolio, which built cat crackers in Genoa and Rome (two 1,500 b/d units). Other medium-size refineries preferred the older, cheaper and better-known way of thermal reforming.

Octane rating of marketed gasoline went up again without any new specification being issued by the authorities as a result of the increase of capacity and of upgrading processes. By European standards, it is now on a very high level, actually the highest in Europe. As recently as 1947-1948, Italian gasoline had the lowest rating in Europe.

At the start of operation of a plant for recovery of gasoline from natural gas at Cortemaggiore (owned by the government company AGIP), 80,000 metric tons/year of a very good motor gasoline joined the increasing stream, and by 1952, national output totaled 1,600,000 metric tons, 850,000 of which went to internal consumption for the man on the road, 100,000 for internal consumption partially or completely exempt from taxes (armed forces, police, foreign tourists, etc.) and the remaining 650,000 tons was exported to countries in the Mediterranean area, the Near East, and in Central Europe. The foreign trade in Italian petroleum products has been strongly favored by the Anglo-Iranian dispute.

To produce this quantity of gasoline, the Italian refining industry worked at a level which can be calculated as 75-80 percent of its effective capacity.

This discussion has dealt with motor fuel thus far, inasmuch as gasoline is the problem for the Italian petroleum industry. Fuel oil has still a good market, although natural gas is expanding and will very soon be a dangerous competitor in the regions served by pipe lines. For gas oil and diesel fuel there is a rather good market too. LPGas consumption expanded very sharply, and more than 120,000 metric tons was consumed during 1952. Internal production for the same year has been around 65,000 tons (against 40,000 in 1951) and the deficit has been filled by imports from The Netherlands, France, Poland and Czechoslovakia.

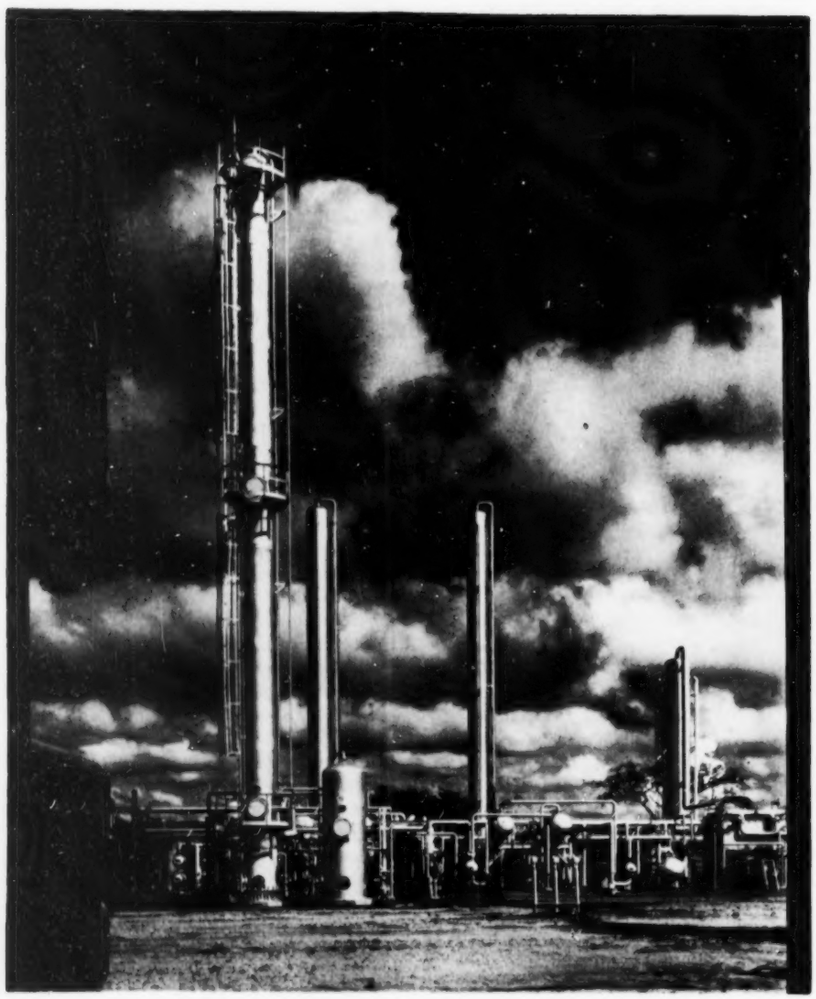
The increase in cracking and thermal reforming capacity all over the country will probably raise the production of LPGas to a level not far from the present consumption. It should be pointed out here that in Italy LPGas is used almost exclusively for domestic purposes, mainly for cooking foods. Commercial heating and industrial uses are not very popular owing to the high price per Btu of liquefied gases as compared with other fuels.

In conclusion, there is still place for the products of the Italian refining industry, and the place could be found in the country itself. More than a half million two-wheel motor vehicles (motorcycles and motorscooters) are running in Italy. Their owners are all potential car-buyers, withheld from the purchase of a car largely by the excessive cost of fuel, not far from 80 cents per U. S. gallon, of which the greater part is represented by tax.

Lowering the gasoline tax could favor decisively the expansion of the petroleum and motor car industries of Italy, and probably could be profitable for the Government through the foreseeable increase in consumption.

Phillips plant supplies Venezuela paraffin demand

Gasoline stabilizer, high and low pressure absorbers, and rich oil still. Photos by Ellwood M. Payne for Chicago Bridge & Iron Co. Ltd., plant constructors.



PHILLIPS OIL COMPANY recently completed a plant for the injection of approximately 30 million cubic feet per day of gas into oil producing formations to increase the production of crude petroleum from the San Roque field in Venezuela. Equipment was installed to gather and process approximately 45 million cubic feet of wet gas per day for the recovery of approximately 1,000 barrels per day of natural gasoline. A crude oil topping plant designed primarily for the production of wax distillate and a paraffin wax plant also was built. These facilities are all complete with utilities, tankage, shops, camps, etc.

The paraffin plant is of primary interest by reason of its being the first such plant to be constructed in South America. The plant, with a design capacity of 1,135 tons annually, will manufacture a 100 percent Venezuelan product of high quality, using as raw material a paraffin distillate separated from the San Roque crude.

Phillips contracted with the Venezuelan Government in 1949 to build the plant after tests of the wax distillate from San Roque crude indicated that high quality paraffin could be manufactured. There is a strong demand for candles in Venezuela and previously all domestic manufacturers had imported their supplies of paraffin, hence announcement of the projected Phillips plant created great interest. Phillips supplied samples of San Roque wax produced in a small pilot plant for commercial testing by Venezuelan candle technicians under varying weather and climatic conditions. The tests proved that wax with melting points between 135° and 140°F from San Roque distillate was a superior product for the area served.

The entire project now in operation represents an investment of about $7 million. First unit to be built was the pressure maintenance plant, which is injecting about 30 million cubic feet into the crude producing formation at 3,500 psi pressure. An 880 hp Clark compressor is employed.

Second step in building the plant was the installation of utilities equipment. Included are two 550 kw Worthington diesel generators, a 25,000 lb/hr steam unit, and a 12,000 b/d water treating unit. The water treater employs lime, alum and chlorine for softening, coagulation and germicidal treating.

Erection of a 12,000 b/d crude stabilization unit was followed by the installation of a 50 million cubic foot natural gasoline plant. In this plant low pressure gas from field separators is passed at 50 psi through the low pressure absorber while high pressure field gas is handled in a 400-lb. absorber. Plant production is about 1,000 b/d.

Final stage in the program was erection of the crude topping unit and the wax finishing plant. The conventional crude still has a capacity of 5,000 b/d,

which is large enough to permit the production of about 4.5 million pounds of wax per year. Minor changes in the original design of the wax plant have made it possible to double the design capacity of about 2,250,000 lbs/yr.

San Roque crude gives a yield of 15-19 percent of paraffin distillate boiling at 650 to 875°F. Other products from the topping still are not finished to commercial specifications at this time but are blended with the natural gasoline and sold as a 52 gravity synthetic crude.

Wax distillate is cooled to 140°F before storage to await processing in the paraffin deoiling plant. Deoiling is accomplished by solvent addition, cooling and filtration under vacuum in three stages.

Paraffin distillate for processing is diluted with cold solvent from the second and third filtration stages and the resulting mixture cooled in a scraped chiller. Cooling is by heat exchange with cold solvent in the first scraped chiller and with cold brine in the second scraped chiller. Temperature in the second chiller is 50°F, at which level all paraffin in the distillate is congealed. It is kept in a slurry form with noncongealed oil and solvent by scraper blades which serve the additional function of preventing paraffin from adhering to tube walls. Additional cold solvent is mixed with the slurry and pumped to the first vacuum filter.

Filters employed are Oliver rotating drums which operate alternately under pressure and vacuum. Wax is picked up on the drum as it passes through a wax slurry bath. Filtrate is drawn through a filter cloth by the inert gas vacuum system. While the drum rotates, wax cake is successively washed with solvent, loosened by inert gas pressure and scraped into a wax pot.

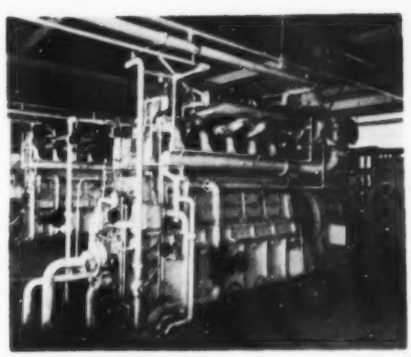
In the wax pot first stage filter cake is reslurried with fresh cold solvent and pumped to the second stage filter. Filter cake from the second wax pot is similarly reslurried with warm solvent. The wax is partly melted before entering the third stage filter. Oil content of the wax is reduced to three percent in the first filter, one percent in the second and 0.5 percent in the third.

Deoiled wax is pumped from the third wax pot to a stripper where solvent is removed for recycling. Wax is cooled to 165°F and percolated through bauxite from which fully refined white paraffin is obtained for the molding machine.

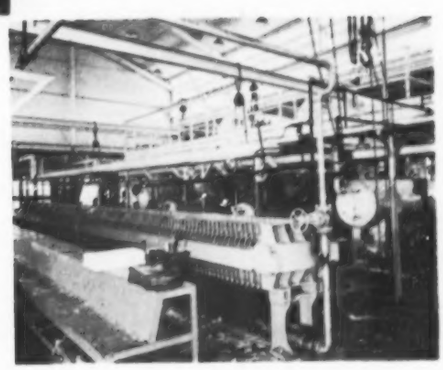
In this machine, the paraffin is molded into panels weighing 5 kilograms and later packed in paper bags of 25 kilograms, and thus it is ready to be shipped to Venezuela candle manufacturers and other processors and consumers. Production of the plant approximates the national demand.

General contractor on the plant erection was Chicago Bridge & Iron Co., Ltd. Engineering work was done by J. F. Pritchard & Co.

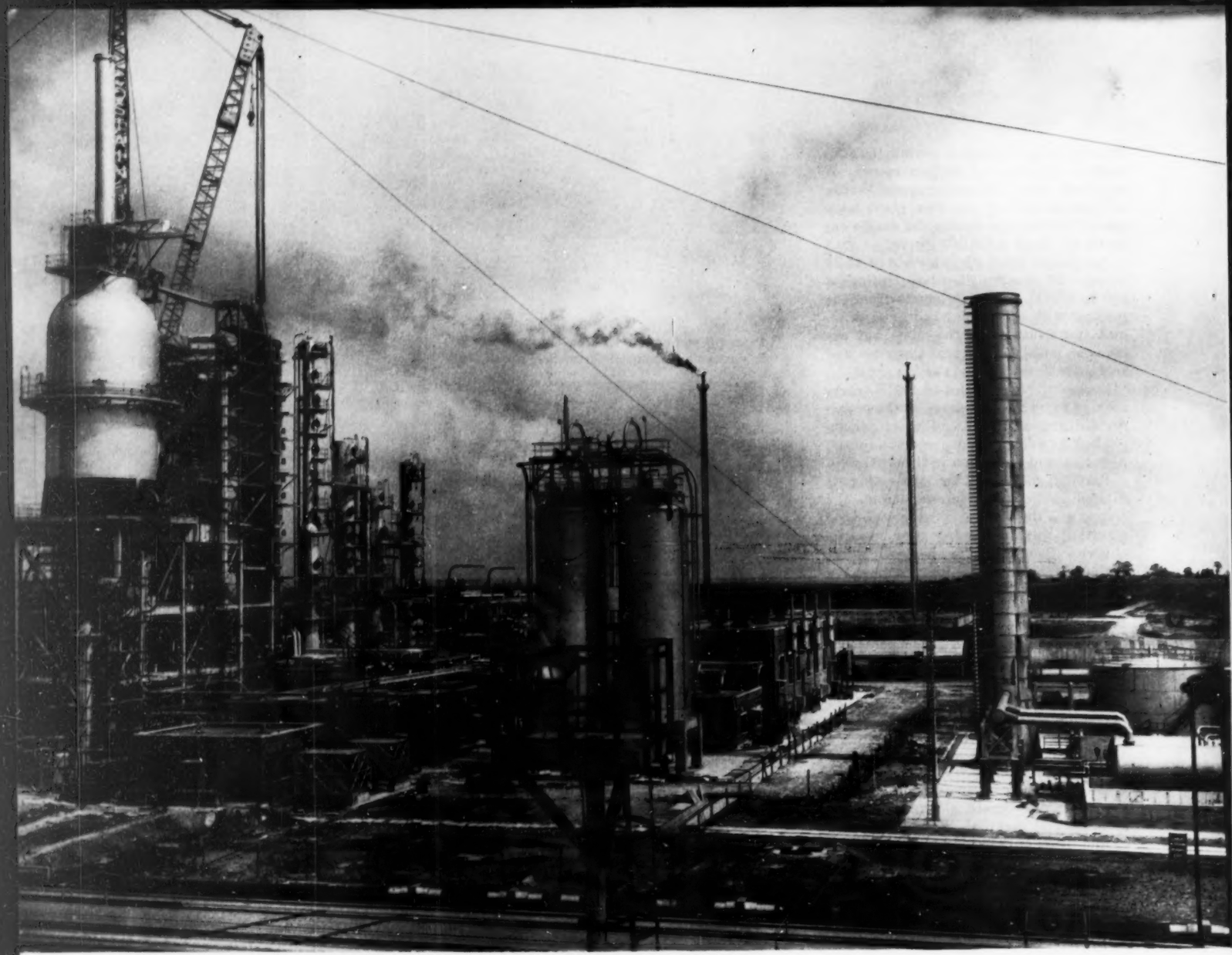
Pipe still and crude fractionating tower used to recover wax distillate from San Roque crude.



Worthington diesel generators.



Wax slabbing equipment.



Catalytic cracker at the Kent refinery of Anglo-Iranian Oil Co. which is to be commissioned during the last half of 1953.

Construction program ahead of schedule in United Kingdom

PROGRESS of the refining industry in the United Kingdom is marked by the increase in crude oil importation. In 1952, 24.4 million metric tons of crude was imported into the U.K., compared with 17.73 million metric tons in 1951, thus the figure of refining in 1952 has exceeded the Government's original program, which envisaged a figure of 20 million tons as the country's refinery requirements.

The present refinery capacity is nearly 25.5 million tons per annum and this is not the ultimate figure, as further capacity still is due to come into production during the coming year.

Imports of refined products all de-

creased in 1952 compared with the 1951 figures, while exports increased and are still increasing. In fact, the United Kingdom is now exporting considerable amounts of refined products. The amount of lubricating oil imported has shown the least percentage decrease, but with the new lubricating oil treatment facilities now coming into operation, this decrease will be more marked in future years.

In the very near future the United Kingdom will be more than self-supporting in refined petroleum products except for specialties. One of these special products is high octane aviation fuel, and it would appear that British refiners are marking time with regard to this commodity until the future aviation requirements are crystallized. All the country's refineries are now in a position to supply motor spirit of a high enough octane number to satisfy the requirements of modern high-compression automobile engines, but considerable capital costs would have to be incurred to provide the plant necessary for turning out high-octane aviation fuels. Such an expenditure at present does not appear to be justified, in view, partly, of the little difference in return between such a product and ordinary high octane motor fuel and partly in view of modern development of the jet engine. For both military and commercial aviation, it now appears that jets will displace reciprocating engines in the fairly near future, and thus an adequate pay-off on the capital required to build avgas facilities is problematical.

A notable change recently is the number of orders which have been placed for Platforming units, which produce spirits of sufficiently high octane number as to render them suitable for military aviation fuels. The construction of one plant is nearing completion and orders have been placed for two others in different refineries in the United Kingdom as well as in British owned or controlled refineries in Germany, France, the Middle East and Australasia.

Considerable progress has been made during the past year on the construction work for completion of the original program for the erection of the Fawley refinery. In some cases, the construction staff has taken delivery of plant, which was in the intermediate stages of fabrication, and completed it on site at an earlier date than could be given by the suppliers, and thus the construction timetable has been adhered to, even in some cases being anticipated.

The light end units of the large catalytic plant have been completed and in operation for some time as has the catalytic polymerization plant.

The tractor fuel plant, which works on a hydrogenation-desulfurization principle, has been completed. The plant produces a high-grade tractor fuel, which is a considerable dollar saver, as prior to its going into operation this type of fuel was imported from the United States.

The deasphalting plant, which is actually one of the units of the lubricating oil refinery, has been completed and is now in operation for deasphalting the cat cracker feed stock.

A small solvent propane unit has been completed and is being used for the production of propane for the above plant, and later will be used for the production of propane to be used in the dewaxing plant. These units were all finished on or ahead of schedule.

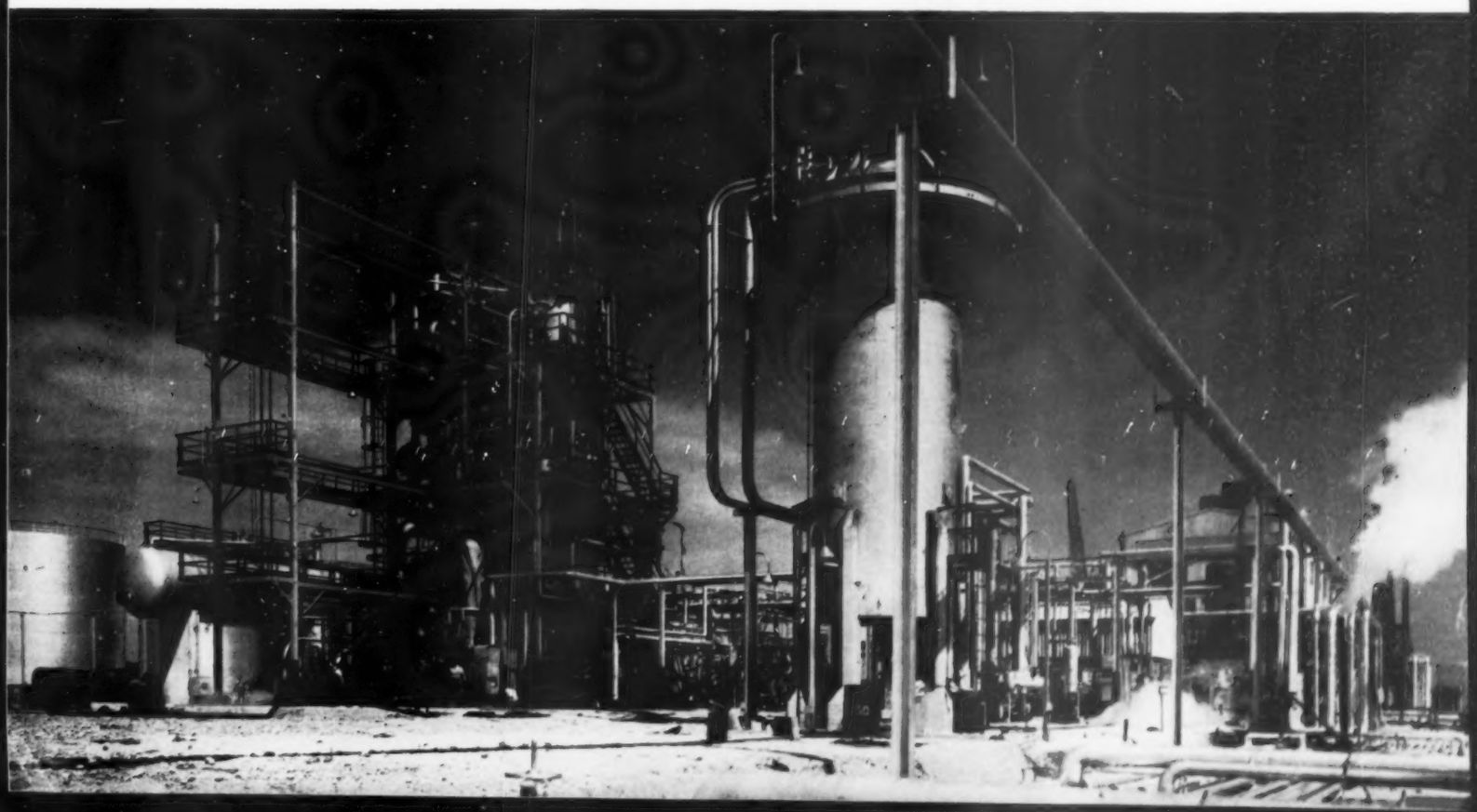
The sulfur plant is also complete and was handed over for production on June 1.

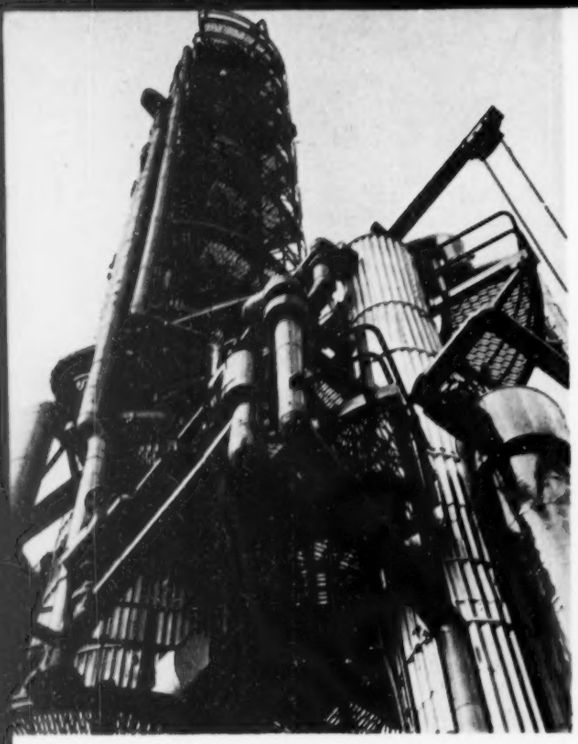
The continuous clay contacting unit is completed, but not yet in operation. This unit will clay treat all the different grades of lubes produced, the plant being worked on block operation.

At the present time, it is not projected to recover the clay, but to pump it as a slurry to the clay disposal plant. This is located in a low area and the clay, after settling out from the slurry, will be used as a filling; the oily water will pass through a separator and the clarified water run to works drains.

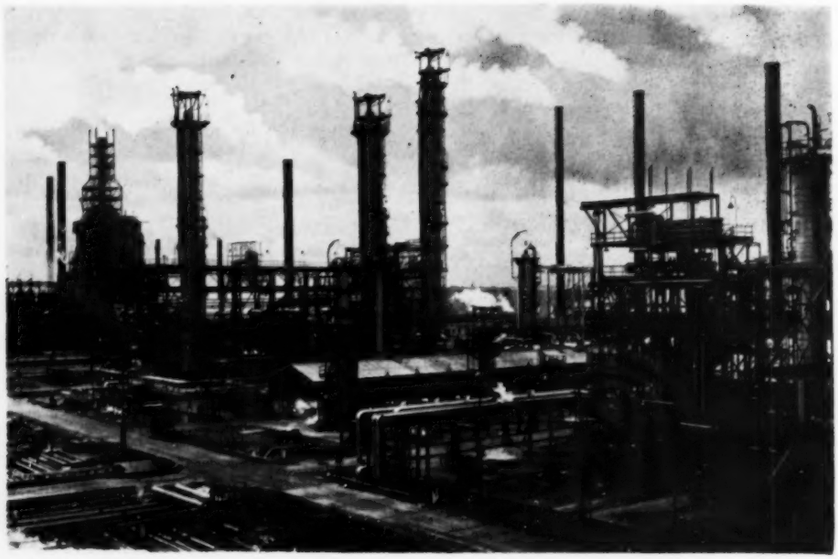
The phenol solvent treating plant and the propane dewaxing unit are scheduled

Propane deasphalting plant now in operation at the Esso refinery, Fawley, England.

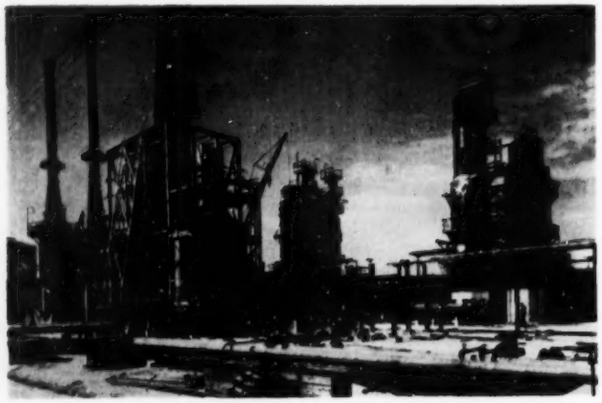




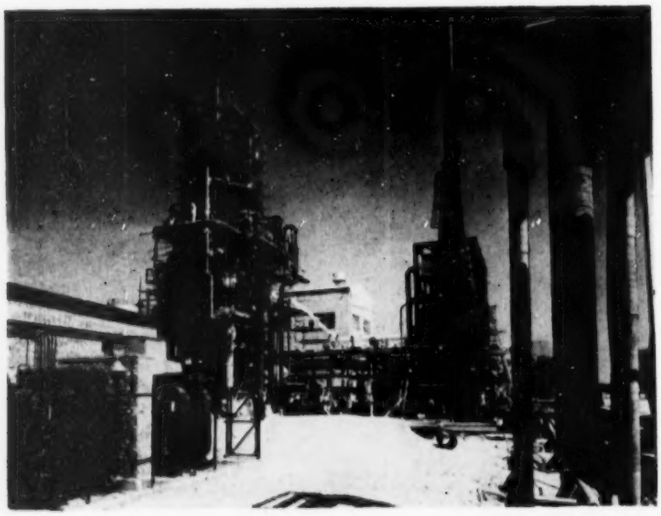
New atmospheric distillation column at the Trafford Park plant of Manchester Oil Refinery Ltd.



Shell's Stanlow refinery, showing cat cracker at left, gas plant in center, and part of the poly unit at right. Shell Photographic Unit photo.



Phenol plant at Esso's Fawley unit.



Clay contact and rerun plant at Fawley where lube facilities are nearing completion.

for completion by September 1, and no delay in this date is anticipated. The whole of the lubrication plant will be finished on this date.

The white spirit unit, which works on the same principle as the tractor fuel unit—i.e. hydrogenation-desulfurization—is scheduled for completion on October 1. Tankage plus coiling is all finished, and all off-site work is ahead of process units.

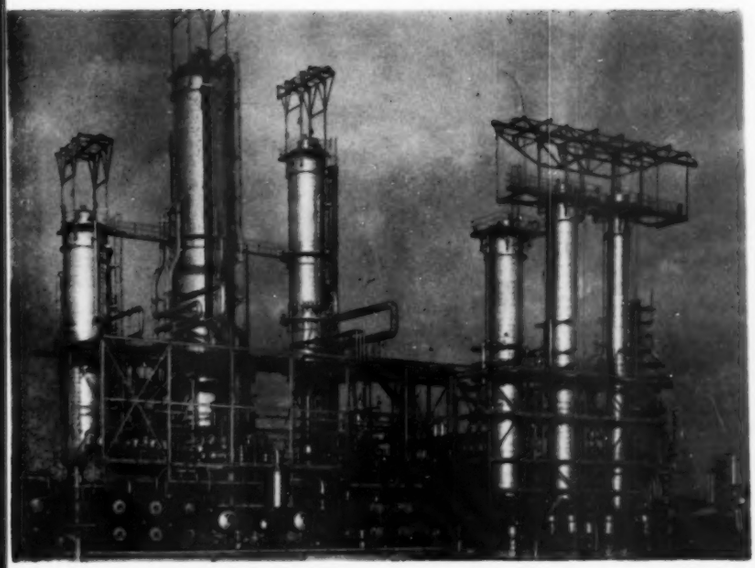
Many grades of lubricating oils will be made, but only four delivery lines to jetties will be used. A special rattling pig has been designed for these lines, which successfully isolates the various grades being pumped through and prevents contamination.

In the old refinery an existing pipe still unit is being re-vamped and a new vacuum tower, with strippers and exchangers, installed which will be used for the treatment of a certain amount of Venezuelan (Tia Juana) crude for the manufacture of lubricants.

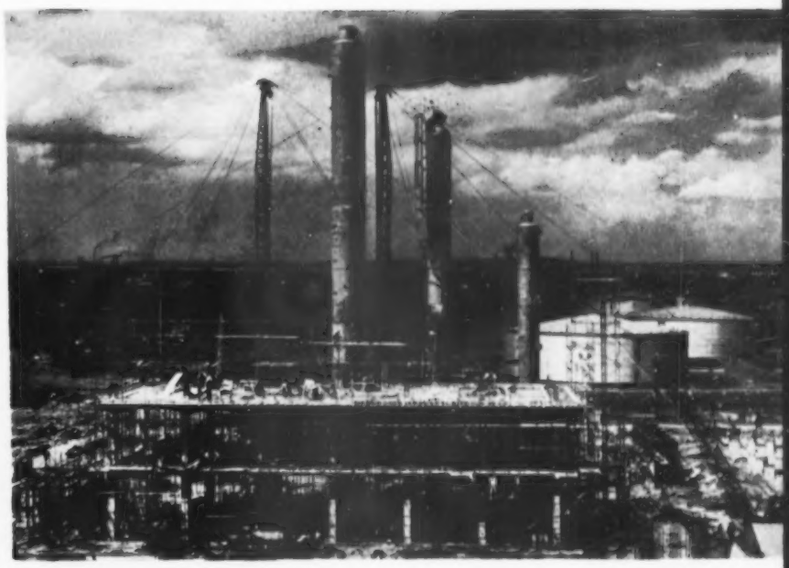
The Stanlow refinery of the Shell Refining and Marketing Co. Ltd. is now a completed unit according to the original program, but like all refineries belonging to progressive oil companies, continues to be added to, altered and improved.

With its crude throughput of 85,000 b/d, it is the second largest refinery in the United Kingdom, but with its multiplicity of products and quantities of these, it is easily first.

The north or older side of the refinery deals with the manufacture of lubricating oils of all types and bitumen products from Venezuelan residues and distillates, while the south, or newer, side deals mainly with the fuels of all grades pro-



No. 2 crude distillation unit at the Stanlow refinery near Ellesmere Port, Cheshire. Shell photo.



First Platformer to be built in Britain is under construction at the Stanlow refinery. Unit will cost £3.5 million. Shell photo.

duced from Middle East crudes. The feed stocks in the north side are processed in three vacuum distillation units for the production of lube oil distillates and bitumen residues, some of which are treated by blowing for the production of various grades of bitumen and cut backs.

The method of treating Venezuelan residue for H.V.I. oils is primary Duosol treatment with propane and Selecto, the latter being a mixture of phenol and cresols. The raffinate is then de-waxed with M.E.K.-benzol, with direct ammonia chilling, and the final raffinate is then fractionated to the required grades by vacuum distillation with a final high temperature fuller's earth (M.R.C.) treatment for color.

Conventional L.V.I. lube oils are produced from the fractionated vacuum distillates by acid and clay treatment.

For the production of M.V.I. oils and the manufacture of transformer, technical white and medicinal oils, a once-run Venezuelan lube distillate is used. This feed stock is vacuum fractionated, and the fractions then solvent treated with liquid sulfur dioxide in an Edeleanu plant and the raffinate treated with acid, or oleum in the case of white oils, neutralized and then followed by clay treatment.

Continuous acid treatment and separation as well as neutralization is embodied in this plant.

The slack wax from the de-waxing of residue for the production of H.V.I. oils is used as feed stock in the preparation of detergents.

There is also a plant on this side of the refinery for the production of narrow range boiling spirits for solvents and other purposes, as well as one for naphtha sulfonate recovery.

The south side refinery is a completely new plant planned for the processing of Middle East crudes. It consists of two crude distillation units with a total capacity of over four million tons per year. The first of these units, which are of Royal Dutch/Shell design, came into operation in 1949, and the second in 1951.

In connection with these is a thermal reforming plant for reforming the naphtha cut.

A fluid bed catalytic cracking plant, of a capacity of one and a quarter million tons per annum of feed, forms part of the plant for the production of motor fuels, the feed stock for this being produced in a vacuum feed preparation unit, part of the residues from this plant going to the north side refinery for bitumen production.

Olefins produced in the reforming plant and cat cracker are partly used as feed stock for the petroleum chemical plant, which is situated close to the refinery, and partly to a polymerization plant for the production of polymer gasolines.

The gasoline and reformate are sweetened in a doctor treating plant. A Girbotol unit is used for the recovery of sulfuretted hydrogen, which is eventually converted into elemental sulfur in a Claus kiln.

At the refinery for the cooling of process water, the world's largest cooling tower has been installed. It is 341 feet high and is capable of efficiently cooling 5,000,000 Imp. gallons of water per hour.

Tanker berthing facilities are being extended by the Manchester Ship Canal Company at Easthaw, about seven miles from the refinery, where a new oil dock is being constructed.

The Shell Group is building a new tank farm close to the dock area which will be connected to the refinery by a 16-inch pipe line.

At the present time, a new Platforming unit is being erected by Procon, Inc. in the new refinery area which is scheduled to come into production toward the end of the year.

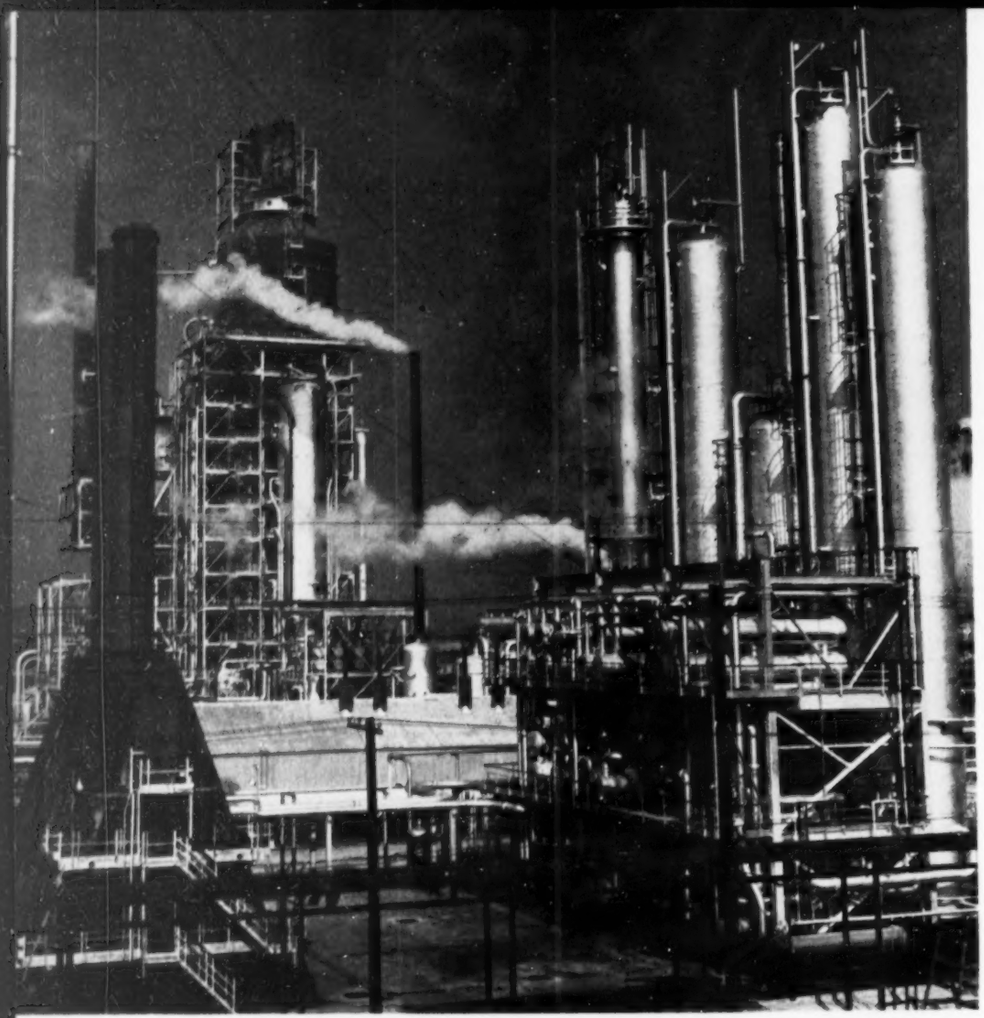
No extensions have been made to the Shell Refineries at Shellhaven, Heysham and Ardrossan during the past year, and they have run satisfactorily to their required capacities. The total refinery capacity in the United Kingdom of the Shell Refining and Marketing Co. is now close to nine million tons per annum.

The Llandarcy refinery of National Oil Refineries (subsidiary of the Anglo-Iranian Oil Co.) has been completely modernized during the last few years and most of the original refinery has been dismantled. In order, however, to maintain the highest possible throughput, one of the original benches of continuous boiler stills is being used and doing good work. The old boiler house containing six Scotch boilers and six Thompson boilers is still in operation pending completion of the new boiler plant.

New tankage and docks have been completed there, now being sufficient accommodation for five tankers simultaneously.

The crude oil distillation plant consists of two units, one being a combination atmospheric and vacuum unit of

(Please turn to page 140)



Baytown's No. 2 Cat Cracker (center) recently expanded to handle 55,000 barrels of oil a day. At right are towers of the catalytic light ends unit.

►

These old tanks furnished steel when a vital part of the No. 1 cat cracker broke down and had to be replaced in a hurry.

Cats run at 300 percent of design capacity

"As the cats go, so goes Baytown." The reference here is to the two fluid catalytic cracking units at Humble Oil & Refining Company's refinery at Baytown on the Houston Ship Channel. Today they are the heart of the Baytown refinery. They affect nearly every phase of the plant operation.

Most of the products of the two cat crackers find their way into Humble's gasolines, while the light ends are used to make such products as butyl rubber, butadiene and alkylate.

The first of these cat cracking units was placed in operation just a little more than 10 years ago. The unit was designed to process 13,400 barrels a day.

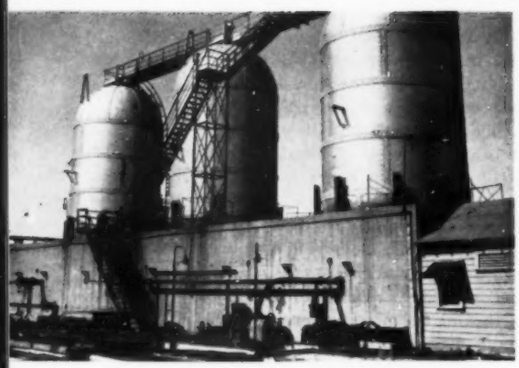
A second cat cracker was placed in operation early in 1944. Design capacity of this one, an improvement over the first, was 16,000 b/d.

Today, each of these giant cat crackers can handle some 55,000 b/d. Capacity of the two is now three times as great as it was when the units first went on stream a decade ago.

Virtually all groups at the Baytown refinery can take some of the credit for tripling the capacity of these two cat crackers. Sound engineering, research, skillful work by mechanical crafts, and process men who could meet new challenges, were combined by a management willing to try new things.

When the first cracking unit was installed, Humble men began at once to search for ways to increase its capacity. Over and around the unit the critics went, searching for things that might be done to send more oil and catalyst surging through the huge vessels and the network of flow lines. Here and there, a revision

Transfer line reactor was a product of research by Humble engineers. It was thrust up through the shell of the old reactor to save time, trouble, and money.



Segments cut carefully from the three old tanks lie near the No. 1 cat cracker and eventually were hauled up and welded into the vessel.

Erosion action of the catalyst cut away these cyclones, or tubes in which catalyst becomes separated from the oil.

or rearrangement of pipes pushed a few more barrels of oil through the unit. Air lines were enlarged. Heat exchangers in "pre-heat" service were arranged to elevate furnace inlet temperatures.

As a result of such improvements, enough bottlenecks were removed between 1943 and 1948 to increase the capacity of the No. 1 cat unit by more than 100 percent. The results encouraged everyone, but there was still plenty to do because the engineers agreed that the unit's ultimate capacity was far from reached.

Next, in 1950, came a thorough study of catalyst heat exchangers. These exchangers were examined under Humble's strict safety standards and found not quite acceptable. They had caused no fires or accidents, but trouble with them had led to occasional downtime. A study of necessary changes to supply supplemental heat led to a design for operations that increased capacity another 7,000 b/d.

Cyclones next were made a subject for special study. First cyclones were designed for fairly low rates and low velocity flow. They eroded badly under high rates and high velocity operation. Now and then, a cat had to be shut down for replacements. Logically, then, the next step to push more oil through the No. 1 cat cracker was to discard the old cyclones and replace them with a new and better model. Research and development had led to cyclones that could handle higher velocity flow and larger volumes of the oil vapor-catalyst mixture. Erosion-resistant materials were used inside the larger cyclones, a feature lacking in the old cyclones.

After the changeover from the old to the new cyclones, the unit's capacity was boosted another 6,000 b/d. The unit was now up to the respectable charge rate of 40,000 b/d, an increase of 200 percent over its original designed capacity of 13,400 barrels a day.

More improvement was yet to come through a complete engineering study of both units. Figuratively speaking, every detail was put under the microscope, there to be studied critically. Special emphasis was placed on possible modification of the auxiliary equipment—such as pumps, furnaces, gas compressors, air blowers, and the like. Instrumentation was examined in an effort to open avenues toward smoother, better production.

The study by the engineers led to major changes. Another furnace was built, a large centrifugal gas compressor was installed, new pumps were added, and a great many flow lines were modified and enlarged. Here, for the first time in the continuous program of expansion, costs ran into big money, but they paid off. These changes upped the No. 1 cat unit's capacity another 15,000 barrels a day, giving it a capacity of 55,000 b/d.

One sidelight of the expansion program at the No. 1 unit bears looking into. When brought down for repairs and changes in 1952, one major item of expense was replacing the catalyst stripper. With the unit down, inspectors and engineers began to go over it for trouble spots. They made a disturbing discovery. Adjacent to the new stripper's location inspectors found a large reactor with its related smaller vessels to be bulged and cracked. The vessels were declared operable for perhaps another six months or so —maybe a year, with good luck, but it was known that the unit would have to be taken out of operation for a costly turnaround inside the normal time limit.

A completely new vessel, made to order and delivered to the jobsite in time, was out of the question. To order the steel, have it rolled and shaped, delivered to Baytown, and welded into the required vessel would take perhaps a year. There was only one thing to do—find the metal close at hand and do a home-made job on it.

An immediate search of nearby sources failed to produce the steel. However, Baytown's own backyard proved to be an ace in the hole. Close by the No. 1 pipe still there stood three old "hot tanks." They were riveted vessels and at least 20 years old. A thorough inspection passed the steel on all tests. Moreover, these old tanks were just the right diameter, so rerolling was unnecessary.

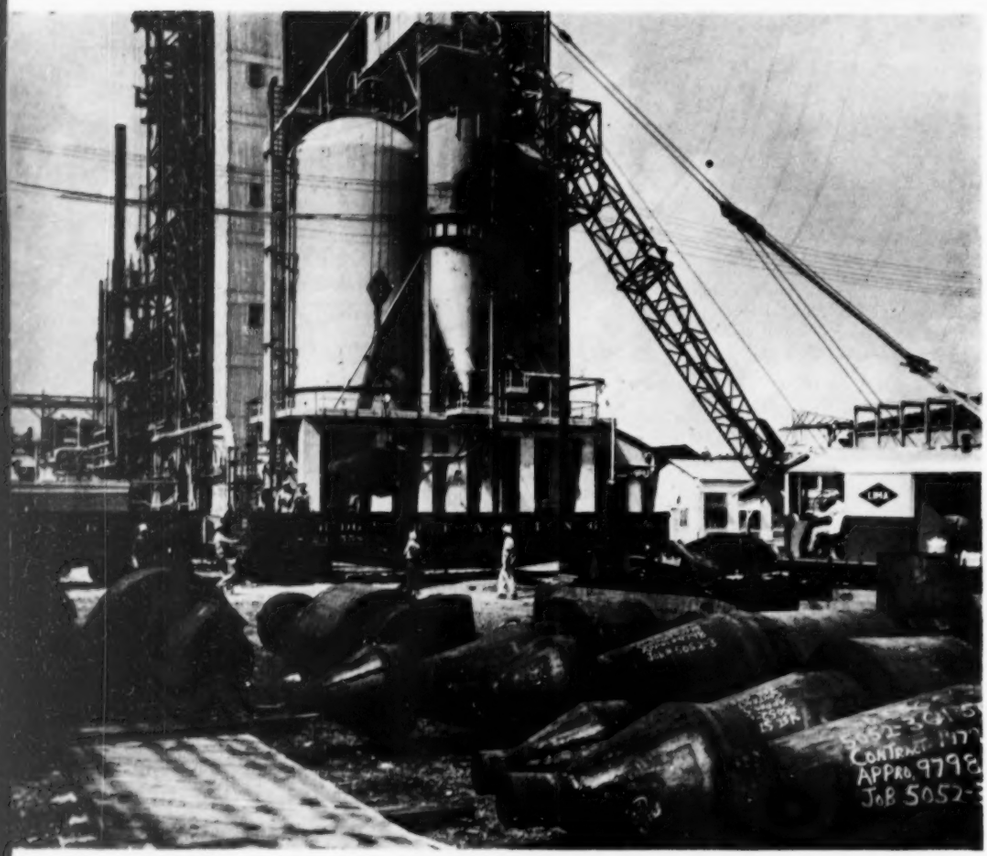
The corps of engineers put all other work aside and addressed themselves steadily to the job of cutting out and putting together a vast jig-saw puzzle. The problem, simply stated but not so simply solved, was to take the three hot tanks, cut out curved plates here and there, and fit the plates together again so as to make a welded vessel of precisely the right proportions.

The home-made vessel did everything it was supposed to do—even better than it was supposed to do. One new vessel had been made to combine the work of several. For in making up the patchwork vessel, design was changed to incorporate smaller vessels into the one large one. End result of the four-in-one piece of equipment was a better operation than the unit had before.

While others worked steadily, in their own way, to increase cat cracking capacity, research men at Humble's "Kitty Cracker" (a smaller pilot unit for study of cat cracker operations) were devoting themselves to the same problem. These men were vitally interested in the reaction that takes place when oil and catalyst meet. To replace large-diameter reactors, the researchers attempted conducting the reaction in a narrower space, at higher velocities. A pilot-sized reactor only an inch in diameter was used at first.

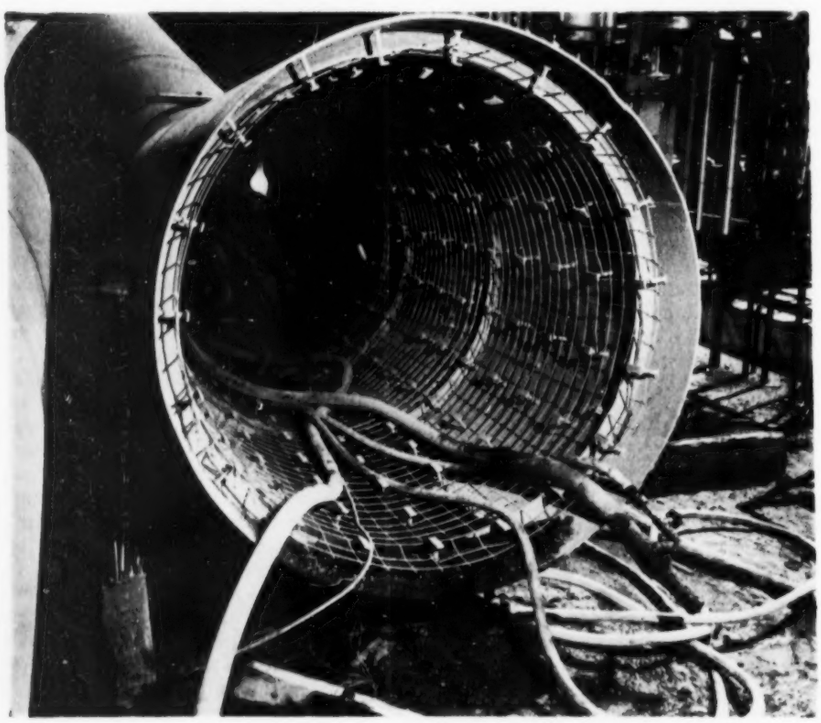
The results were good. Product distribution from the experiment gave an even greater proportion of the more desirable oils, but what would happen when the one-inch test reactor was scaled up to a commercial reactor many feet in diameter? No one knew, but the experiment gave promise to success, if all could be persuaded to take the chance.

With evidence at hand to give management reasonable assurance of success, an entirely new-design reactor was built and installed at the No. 1 cat cracker. Actually, it was more of a big line than a vessel like the old reactor, and earned the



New type cyclones are larger, handle higher velocity flow, resist erosion better, and add to the capacity of the two cats.

Insulating catalyst lines on the inside greatly reduces erosion, keeps the unit in operation longer.



title "transfer line reactor." The new reactor worked when the unit went back on stream in September 1952.

With a radically new reactor, a new catalyst, and a home-made regenerated catalyst hopper—not to speak of scores of other changes of smaller nature—the No. 1 cat cracker bears little resemblance to its old self.

The expansion program brought up other problems, including that of training men to cope with the operation of this virtual stranger. The training job began early and actual class room studies were held on the job—to trace new flow systems, study new heating problems, acquaint everyone with the location and use of new equipment, and get ready for bringing the face-lifted unit back into production.

Expansion posed new maintenance problems, too. Simply speaking, there was more for maintenance men to maintain. Also, the work of expansion had increased the difficulties of maintaining equipment.

But these rough spots were smoothed out through cooperation among the Baytown people. It was not long before all hands were as comfortably at home with the new cat as they had been with the old one.

Few of the changes made to increase the No. 2 cat cracker's capacity were quite as radical as those made on its companion unit. The same pattern was followed of study and change and modification. As a result, No. 2's capacity was pushed upward in about the same proportion as that of No. 1.

Removal of bottlenecks by changing and substituting equipment between 1944 and 1948 increased capacity from 16,000 to 38,000 b/d. Modern cyclones added another 1,000 barrels. Subsequent detailed engineering study brought on the biggest increase — an extra 16,000 b/d, up to a daily total of 55,000 barrels.

The expansion of the cat cracker capacity at Baytown certainly had an effect on other refinery operations. For example, with cracking capacity up, the two cat crackers needed more feed stock to crack. This will be provided when a de-asphalting plant, now under construction, is completed. The plant will take pipe still bottoms, remove the asphalt, and convert the remainder to good quality gas oil for use as cat cracker feed.

Just as more feed stock was needed, so were added facilities to handle what the cats produce. The CLEU (catalytic light ends unit) is an example. With the cat crackers turning out more light ends, the CLEU was running wide open, producing at just about its top capacity. Another such unit was needed and ground already has been broken for it.

Thus it is that a major expansion of a key process like catalytic cracking makes itself felt all over the refinery. So profound is its influence on other processes that expansion in one direction must be followed by expansion in others.

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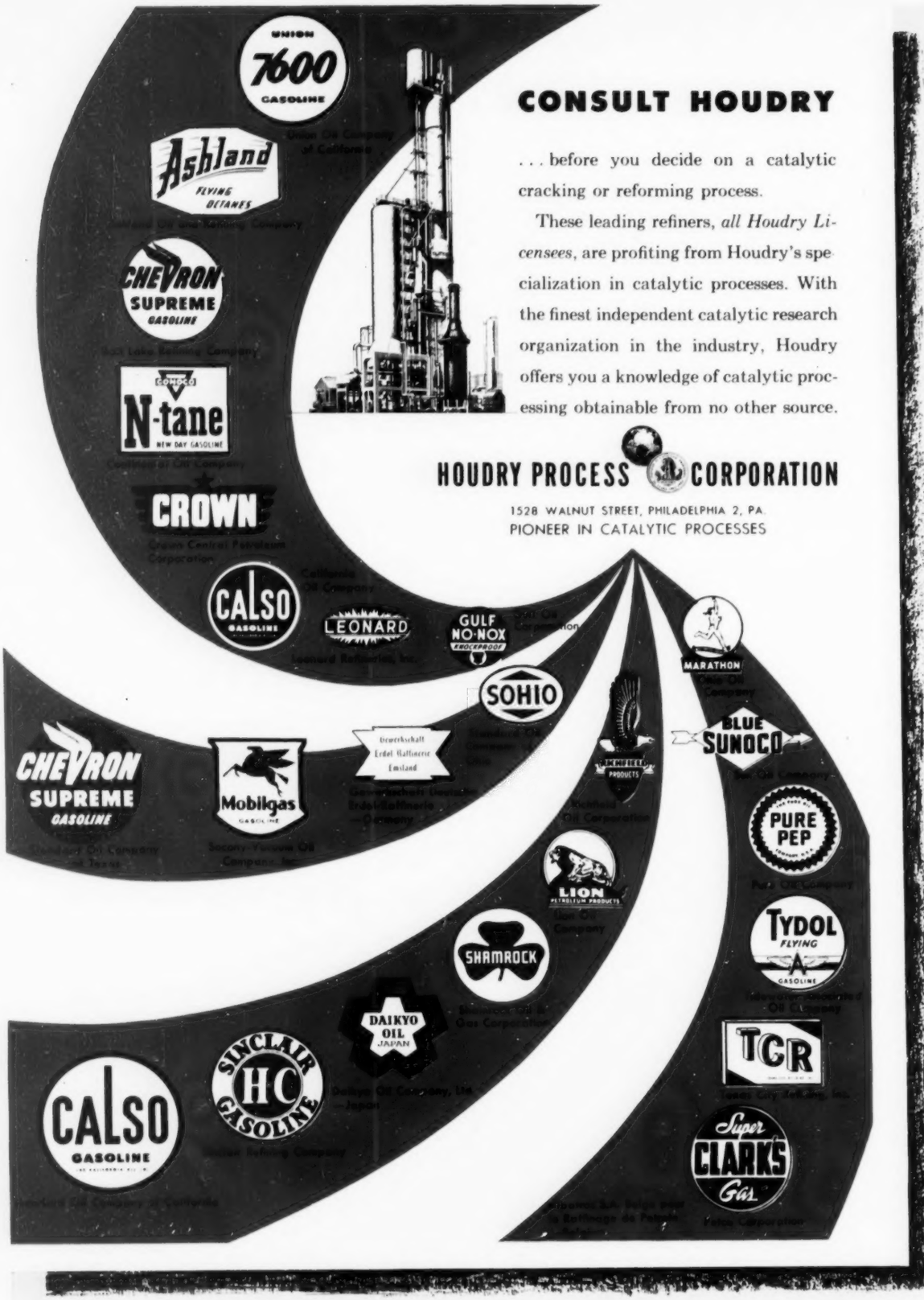

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Recent trends in petroleum refining patents

By Felix Heinemann and Heinz Heinemann

Dr. Felix Heinemann studied chemistry in Germany and received a Ph.D. from the University of Berlin. He was active as a patent attorney in Germany, and as such handled most of the patent work connected with the development of the Fischer-Tropsch synthesis process. After several years in England he came to the United States in 1943 and now is a consulting chemist and chemical engineer.

F. Heinemann *H. Heinemann*

Dr. Heinz Heinemann is in charge of process research for Houdry Process Corp., Philadelphia. He received his Ph.D. from the University of Basle, Switzerland, in 1937 and came to the United States the following year. He is the author of many papers in the hydrocarbon field. Among his professional groups is the Catalysis Club of Philadelphia, of which he is chairman-elect.

BETWEEN six hundred and nine hundred United States patents are issued each week. Of these, twenty-five to forty are of direct interest to the petroleum refining industry and cover advances in one of the many branches of science which contribute to the industry. Some patents propose new methods of treating or processing hydrocarbons, while others comprise modifications and improvements of known processes. Only a few of the patents may be of immediate commercial value, but others may contain the basic developments on which future processes are based. A large majority of the patents is in the chemical field, but there is always a substantial number of mechanical and electrical features covered.

In assessing trends during any one period (the present survey covers a six months interval from November 1952 to April 1953), it is obviously difficult to decide which patents are more important or of more general interest than others. The reviewers' own interests will play a part in the selection, as will the current ideas and needs of the industry. Such a choice is necessarily arbitrary and patents which would seem important to some readers will have been omitted from consideration. An attempt has been made in this review to gather in each field of activities those patents which appeared characteristic for or typical of the ideas and research activities predominant during the period reviewed, though not all modifications or ideas could be considered due to space limitations.

In evaluating this review, it should be kept in mind that a period of from two to five years usually elapses between application for and issuance of a patent and that application is frequently made only after prolonged study in research and development laboratories. Patents issued, therefore, represent the thinking of the inventors and their laboratories as of several years ago, and may pertain to subjects which have since been commercialized and published or, on the contrary, may have been dropped for one of the many reasons which cause abandoning of research projects.

The division of this review into several fields of activity is arbitrary and has been made only to facilitate finding of one's subjects of prime interest.

Cracking and Reforming: The number of chemical patents which have recently been issued in this field is relatively small, only about four percent of the patents in the petroleum field during the period reviewed. This probably indicates that catalytic cracking had been well developed and covered (other than for design and mechanical operating features) and that the great bulk of the work on catalytic reforming had not yet produced many patent applications at the time at which patents now issuing were filed.

Recent patents issued to Houdry Process Corporation and of interest in connecnection with the Houdriflow process comprise the description of a chamber to disengage gases from a moving bed of fluent solid particles (No. 2,628,893, R. Kollgaard) and a cracking process (No. 2,628,188, C. G. Kirkbride and J. C. Dart) embodying a cyclic system in which catalyst is fed by gravity from a regenerating zone to a lift pipe through which it is lifted to a disengager by the force of upward flowing crackable hydrocarbon vapors. Catalyst flows from the disengager to the regenerator. The regeneration is controlled so that regenerated catalyst entering the lift pipe is at the temperature required to facilitate the desired degree of cracking in the lift pipe.

Cracking of saturated hydrocarbons with an activated carbon catalyst at 800° to 1,050°F. and atmospheric pressure is described in a Standard Oil Development Company patent (2,626,233, C. N. Kimberlin and E. M. Gladrow). The reaction is carried out in the presence of normally

Recent Trends in Petroleum Refining Patents

(Continued from preceding page)

gaseous olefins which act as hydrogen acceptors. Cracked unsaturated hydrocarbons are formed. Hydrogen transfer in the reverse direction is the subject of a Phillips Petroleum Company patent (2,620,293, R. W. Blue and C. J. Engle). Here, an oil residuum is converted to lighter hydrocarbons, such as a catalytic cracking feed stock, over a plurality of catalysts having cracking and hydrogen transfer properties. A naphthene hydrocarbon is employed as a hydrogen donor.

Activated carbon is also the catalyst for a naphtha reforming process claimed by Sinclair Refining Company (2,592,603, R. A. Sanford and B. S. Friedman). The carbon is modified by promoters (1-10 percent) consisting of alkaline compounds, such as salts of an alkali metal. The catalyst can be regenerated with steam at temperatures of about 1300°F.

A considerable number of patents has been issued to Universal Oil Products Company in connection with the Platforming process. According to patent 2,625,504 (V. Haensel and C. E. Gerald), a gasoline fraction to be reformed is contacted with a catalyst prepared by compositing 0.01 to 2 percent of platinum with a cracking component comprising alumina and boron oxide. The method of preparation of a platinum-alumina reforming catalyst containing 0.01 to 10 percent platinum and 0.1 to 8 percent combined halogen is described in 2,631,136 (V. Haensel). Aqueous solutions of a platinum compound, a hydrogen halide and ammonium hydroxide in an amount to raise the pH to above seven are commingled, and after heating, the resulting complex solution is impregnated on alumina. Other methods of controlling the pH of the impregnating solution are contained in 2,623,860 and 2,623,861 (V. Haensel). A process for contacting a straight-run gasoline fraction with an olefinic hydrocarbon in the presence of a platinum-alumina catalyst at 750° to 1,000°F. and above 100 psi. pressure is claimed in 2,630,404 (C. V. Berger).

Refining: A very large number of patents has issued in recent months concerned with methods of separation of hydrocarbons either by selective adsorption or by compound formation. Typical are some patents to Sun Oil Company involving the separation of aromatic and saturated hydrocarbons by means of selective adsorption and desorption on silica gel (2,614,133, C. E. Ockert) which may have undergone special treatment, for instance with a silane (2,614,135, A. E. Hirschler). Carbon or silica gels are used as adsorbents for the segregation of normal from isoparaffins according to 2,620,363 (H. J. Hibschman to Standard Oil Development Company). The adsorption process is carried out in two adsorption stages, each of which operates on a differently boiling feed stock. The enriched adsorbent from each stage is washed with the filtrate derived from the other stage.

Urea addition of normal aliphatic compounds in the presence of less than 5 percent methanol at below 32°F. as a means of segregation from other types of hydrocarbons is discussed by W. F. Avey, Jr. (2,627,513 to Standard Oil Development Company). Urea adducts of straight carbon chain hydrocarbons of at least six carbon atoms per mole can be decomposed by suspending the adduct in a preheated inert carrier gas which is then heated to decomposition temperature in a reaction zone (2,619,501, G. C. Ray to Phillips Petroleum Company). In another Phillips Petroleum Company patent (2,622,115), S. C. Carney discusses separation of eutectic forming mixtures, such as m- and p-xylenes by crystallization methods.

Improvement of the oxidation stability of gasoline and heavier hydrocarbons is the subject of Standard Oil Development Company patents 2,614,966 and 2,614,967 (B. M. Vanderbilt and A. H. Gleason) covering treatment of the hydrocarbon with 0.25 to two percent of finely divided alkali metal and five to 30 percent of an activating ether, ketone or alcohol.

A phase of Standard Oil Company of Indiana's new process for refining with liquid hydrogen fluoride is disclosed in 2,612,464 (J. J. Giaschetto, D.H. Wagner and J. E. Wolf). In the treatment of hydrocarbon charging stock (boiling above the gasoline range and containing sulfur compounds and water) with liquid HF to produce a solution of water, hydrogen sulfide and other sulfur compounds in liquid HF and an HF-immiscible purified charging stock HF is separately removed from the resulting solution and from the stock under conditions to give condensed HF containing less than one percent water, an HF-water condensate free from hydrogen sulfide, and a hydrogen sulfide-containing gas stream. Anhydrous HF is obtained from the condensate by distillation, and HF is also recovered from the other liquids and gases remaining after the recovery of the anhydrous HF.

There are always patents on gasoline additives to improve performance in the internal combustion engine. In 2,628,895, the Indium Corporation of America (W. S. Murray and J. R. Dyer) uses indium laurate to inhibit carbon deposition in the combustion chamber.

Catalysts: In the field of silica-alumina cracking catalysts, H. A. Shabaker describes a new method of forming bead catalysts (2,616,857 to Houdry Process Corporation). Spent catalysts are regenerated by treatment with one to two percent ammonium fluoride solution and subsequent steam treating at 1,050°F. and 60 psi., according to C. N. Kimberlin and J. P. Bilisoly (2,618,613 to Standard Oil Development Company). A method of separating active from inactive finely divided microporous catalyst is disclosed in Shell Development Company patent 2,631,968 (N. E. Peevy). Used catalyst is dispersed in a liquid having a density intermediate between the apparent density of most dense and least dense catalyst particles. The portion of catalyst which floats on the liquid is returned to use, while the rest is discarded and replaced by fresh catalyst. Hydration of cracking catalysts has been of interest for some time. Controlled hydration is obtained by A. F. Kaulakis (2,631,123 to Standard Oil Development Company) by supplying steam to individual sections of a standpipe through which the catalyst passes.

A series of patents has been issued to S. P. Robinson of Phillips Petroleum Company on a process for manufacturing stabilized alumina pebbles highly resistant to attrition and breakage under cyclic and thermal shock conditions (2,633,622-3: 2,631,353). Vanadium or zirconium is incorporated into the alumina which is then shaped and calcined at 2,900° to 3,200°F.

Polymerization: The major portion of the patents on polymerization which have issued during the past six months is devoted to the production of high polymer plastics. The number of patents on hydrocarbon polymerization to intermediate molecular weight hydrocarbons has steadily declined in recent years.

A vinyl co-polymerization process is described by J. A. Arvin (2,627,509 to Sherwin-Williams Company). An oleoresinous varnish is heated to 325° to 550°F. and 10 to 100 percent styrene is gradually added while bubbling sulfur dioxide through the mixture. Several patents deal with polymerization modifiers or inhibitors. A mono-olefin is used as a modifier by Sparks and Nelson (2,625,538 to Standard Oil Development Company), while alkali metal or alkaline earth metal nitrite are used as inhibitors for butadiene polymerization during fractionation (2,613,175, Johnstone, Webber and Costulow to Phillips Petroleum Company).

Polymerization of C_3 to C_{10} mono-olefins with a boron phosphate catalyst at 150° to 600°F. is described by R. C. Krug (2,620,364 to The Atlantic Refining Company).

Catalyst deactivation in slurry polymerization may be overcome according to 2,626,293 (S. B. Sweetser) by adding a silica gel of specific properties to the slurry as a diluent.

Isomerization and Alkylation: Both of these subjects, which only a few years back were very active, now constitute one of the smallest groups of the classes of reactions considered for this review.

Alkylation of aromatics with saturated hydrocarbons having at least five carbon atoms and at least one tertiary carbon atom per mole is discussed by R. M. Kennedy and A. Schneider (2,626,966 to Sun Oil Company). BF_3 and a tertiary alkyl monofluoride are used as catalyst and the fluoride must have a different number of

(Please turn to page 144)

The Jungle and the Jet

IN THE HEART of the Papuan jungle Anglo-Iranian has drilled its deepest well—nearly 13,000 feet of it! In Sicily, East Africa and England, too, the search for oil goes on. Anglo-Iranian is finding the oil and refining it—turning it to use in a hundred ways, from fuel for jets to fruit tree sprays.

Anglo-Iranian ships the oil it produces in one of the world's largest privately-owned tanker fleets. It refines oil in seven countries. Its markets stretch from Iceland to Tasmania.

With the latest equipment, eager workers and a progressive outlook, Anglo-Iranian is keeping well to the fore in every branch of the oil business.

THE BP SHIELD IS THE SYMBOL OF THE WORLD-WIDE ORGANISATION OF

Anglo-Iranian Oil Company
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REPRESENTATIVE IN U.S.A.: A. E. C. DRAKE, 610 FIFTH AVENUE, NEW YORK 20, N. Y.

U. S. refining capacity increasing at five percent annual rate

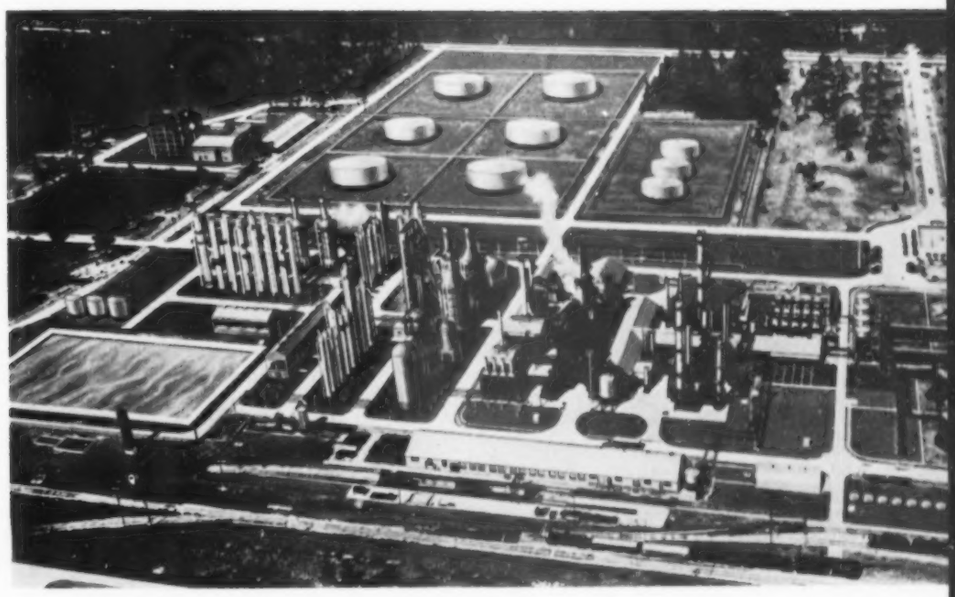
Shell Oil Company's Wood River, Ill., refinery modernization now is in its second year. View shows new crude distillation unit in course of construction. Photo courtesy Foster-Wheeler Corp.

Gulf Oil Corporation expansion at Philadelphia includes erection of a 63,000-barrel cat cracker. Photo courtesy M. W. Kellogg Co.

REFINERY construction in the United States is proceeding at a rate which will substantially meet goals established a year ago by the Petroleum Administration for Defense. The PAD approved an expansion in crude capacity of 750,000 barrels daily in the 18 months ending December 31, 1953. Target for the end of this year was 8,150,000 b/d, and for the end of 1954 a goal of 8,306,000 b/d was set.

At the beginning of 1952, U. S. capacity was about 7,359,000 b/d. Actual increase attained last year was 275,000 barrels to 7,734,000 b/d. At mid-year it now seems likely that capacity next December will be 8,099,000 b/d, an increase for the year of 365,000 b/d. A year later capacity should rise to 8,405,000 b/d.

The increase in capacity has been roughly at the rate of five percent per annum. This was calculated to take care of the normal rate of increase in demand for refined products and to build a reasonable cushion for a national emergency. In addition to crude capacity, the PAD set up objectives for the production of largely increased quantities of aviation gasoline and certain petrochemicals, notably the aromatics such as benzene and toluene. These tar-



Continental Oil Company is nearing completion of its $27 million expansion at Lake Charles, La. Capacity will rise from 12,000 to 40,000 b/d when the plant goes on stream late this month or in August.

gets are being reached and even exceeded.

In 1952, U. S. refiners processed an average of 6,700,000 b/d of crude, utilizing 89 percent of estimated average capacity. Runs were three percent higher than in 1951. The percent change was less than normal because of the spring strike which shut down a substantial share of the industry. This year runs increased 4.2 percent in the first quarter, a period which was directly comparable with 1952. An increase in domestic demand for the year of 4.1 percent has been forecast by industry economists serving on a committee of the Independent Petroleum Association of America.

Sales records in recent months indicate that demand this year may be considerably better than had been anticipated. It is indicated that the PAD program may have to be revised upwards. For 1954 an increase of only 306,000 b/d in capacity is projected. In comparison demand in 1952 rose an average 254,000 b/d and the average early this year was running 380,000 b/d over the corresponding period of 1952.

In terms of percentages, U. S. still capacity rose 5.1 percent in 1952, will increase 4.7 percent this year and only 3.7 percent in 1954 unless new projects are scheduled.

Greatest increase in still capacity in the current year will be along the Atlantic seaboard. Capacity there will rise 116,000 b/d during 1953 to 1,356,000 b/d. The increase will approximate nine percent in a single year. In 1954 the rate will diminish somewhat, but currently approved projects scheduled for completion next year total 50,000 b/d, an additional increase of about 4 percent.

One outstanding feature of the present refinery construction program in the United States is the large number of alkylation plants being built. Many plants built in World War II are being reactivated and enlarged and other new units are being built at the request of the Petroleum Administration. A year ago, about 30,000 b/d of alkylation capacity was idle. This has been reduced to a minimum and now new capacity is coming on stream from month to month.

Even more spectacular is the rapid growth in catalytic reforming operations. In 1952 reforming capacity increased more than 50 percent to 124,728 b/d at the beginning of the present year. By December 31 this will increase an additional 85 percent to 235,128 b/d. In 1954 at least another 115,000 barrels of catalytic reformer capacity will be ready for operation. In addition to the fluid hydroformer and TCR moving bed catalytic processes, there are a number of fixed bed platinum catalyst processes offered the refiner.

A similarly fast pace is evident in catalytic cracking construction. Capacity of cat crackers increased 200,000 b/d in 1952 and will increase another 308,000 b/d this year.

The current building program on the Atlantic seaboard is restoring to this area the importance it held as a refining center a generation ago. In the interval between the two World Wars, the tendency was to build huge plants on the Gulf Coast and supply the East Coast by tanker. Refining costs were somewhat lower on the Gulf, and shipping costs were minimized because deliveries of finished products could be made direct to marine terminals along the entire eastern seaboard. With refineries on the East Coast, it was necessary to ship crude in by tanker and reship finished products to terminals, thus duplicating a considerable part of the transportation function.

Concentration of refineries on the Gulf Coast accentuated the problems of supplying petroleum products to eastern states during the height of the submarine warfare in World War I.

Aside from the national defense aspect the present tendency to enlarge East Coast capacity faster than the Gulf may be attributed to a change in crude source. Much of the crude processed in the east now is imported from Venezuela or the Middle East. From Venezuela or the Mediterranean to Philadelphia or New York, the distance is less than to Port Arthur or Houston. Transportation costs based on East Coast refining thus are lower than the Gulf for plants operating on foreign crude and higher when running Mid-Continent crude.

Outstanding project expected to be completed in the east this year is at the Philadelphia refinery of Gulf Oil Corporation. Two king-size units feature this

major expansion. Foster-Wheeler Corporation is building an atmospheric and vacuum topping still which will have a capacity of 125,000 b/d and the M. W. Kellogg Co. is contractor on a 63,000 b/d fluid cat cracker. The catalytic reformer being built for Gulf by Procon, Inc. is among the largest thus far built. It will have a fresh feed charge of 16,000 b/d. Another processing unit making up the project will employ the acid film catalytic polymerization method. Completing the immediate project will be a 30,000 KW power plant and a 900,000 lbs. per hr steam plant engineered by Gulf and built by Day and Zimmerman.

The power and boiler plants and the cat cracker are expected to be ready for operation on Nov. 1 and the crude still and polymerization unit about 60 days later. Completion of the Platformer will be March 1, 1954.

Atlantic Refining Co. is currently completing a 100-ton ammonia plant. Later in the year an expanded alkylation unit with a 3,000 b/d capacity will be ready for operation as well as a 10,000 b/d Catformer, a platinum naphtha reforming process developed by Atlantic. Another such unit is being built at Atreco, Texas, by Atlantic. Next year a new 45,000 b/d crude unit and a 30,000 b/d cat cracker will go on stream.

California Oil Co. is converting its former thermal reforming unit at Barber, N. J., to a 10,000 b/d Platformer. Field work has commenced and completion is anticipated early next year. Universal Oil Products Co. did the engineering and Bechtel Corp. is building the unit. In May the company completed a California Research phosphoric acid polymerization unit. Hydrocarbon Research engineered and constructed the unit.

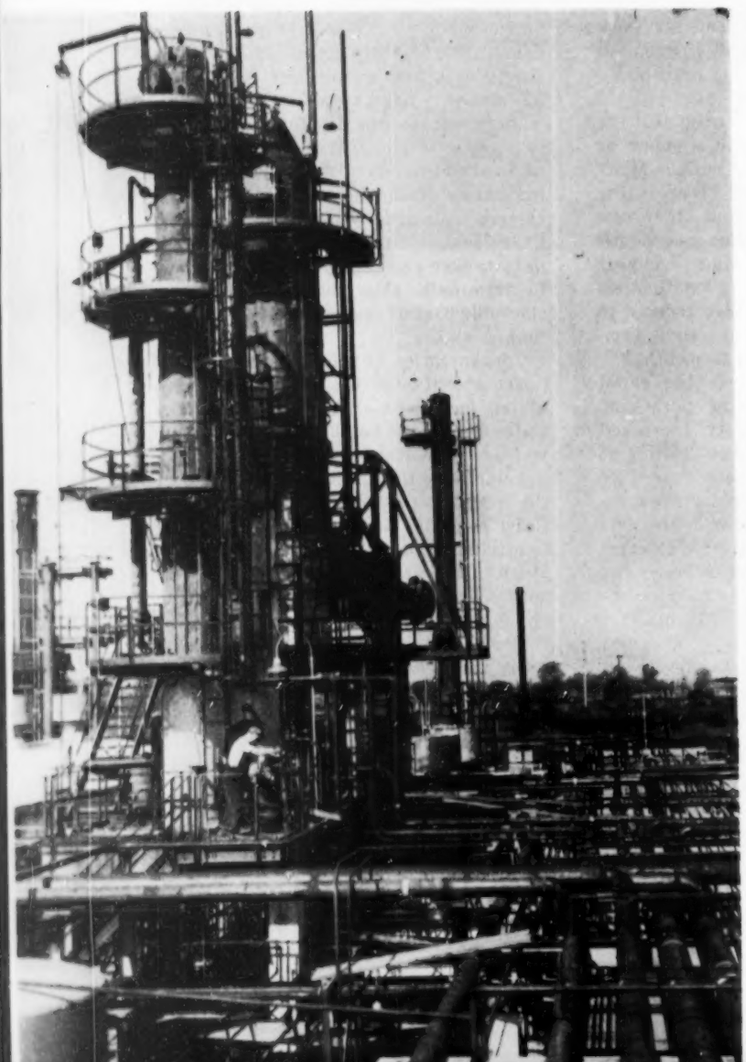
A probable newcomer as a refinery in the Northern Atlantic seaboard is Pan American Refining Corp. which is actively developing possible plant sites. Options have been obtained completely covering two sites and the company is in the process of obtaining options on a third site. These are near Pedricktown, N. J., on the Delaware River; Talbot county on the eastern shore of Maryland; and Portsmouth, R. I.

Approval of the new refinery has been given by the Petroleum Administration for Defense and the Office of Defense Mobilization based on the New Jersey site. Since a final decision as to the site has not been made, engineering design work has not been started. However, it is estimated that the refinery will cost in the neighborhood of $20 million to construct, and that it will process about 25,000 barrels of crude oil a stream day.

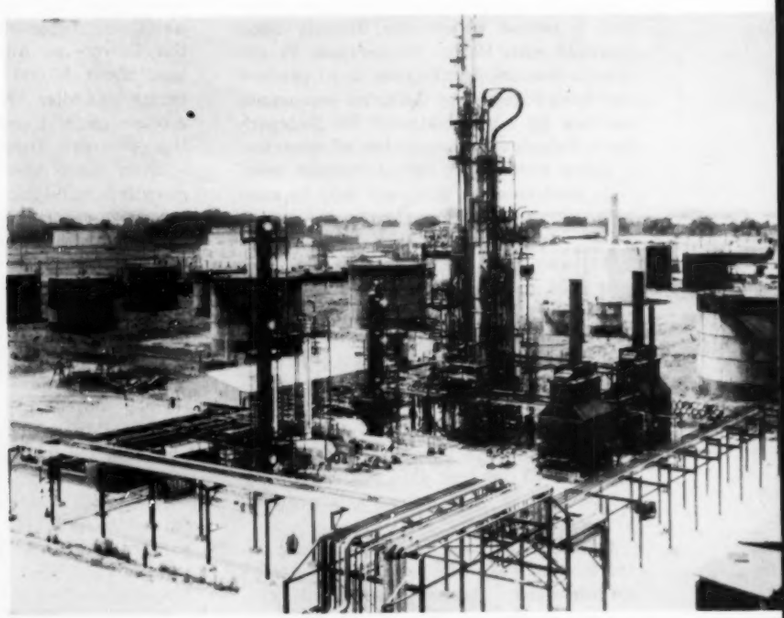
Esso Standard Oil Co. is rounding out facilities at its Everett, Mass., refinery and expanding crude capacity at Linden, N. J. At Everett a fluid cat cracker of 18,500 b/d capacity is nearing completion and will be on stream within the next 60 days. An LPGas recovery plant is to be installed also. This unit will require another year for completion.

At Linden, Standard is building a 60,000 b/d crude still. Expected completion is in the third quarter of 1954. At about the same time a 21,500 b/d Hydrofining unit will go on stream. Standard Oil Development Co. has done the engineering on the Hydrofining unit and C. F. Braun Co. is the contractor. At Bayonne, Fluor Corp. is building a 3,500 b/d wax pipe still for Standard which will go on stream late this year.

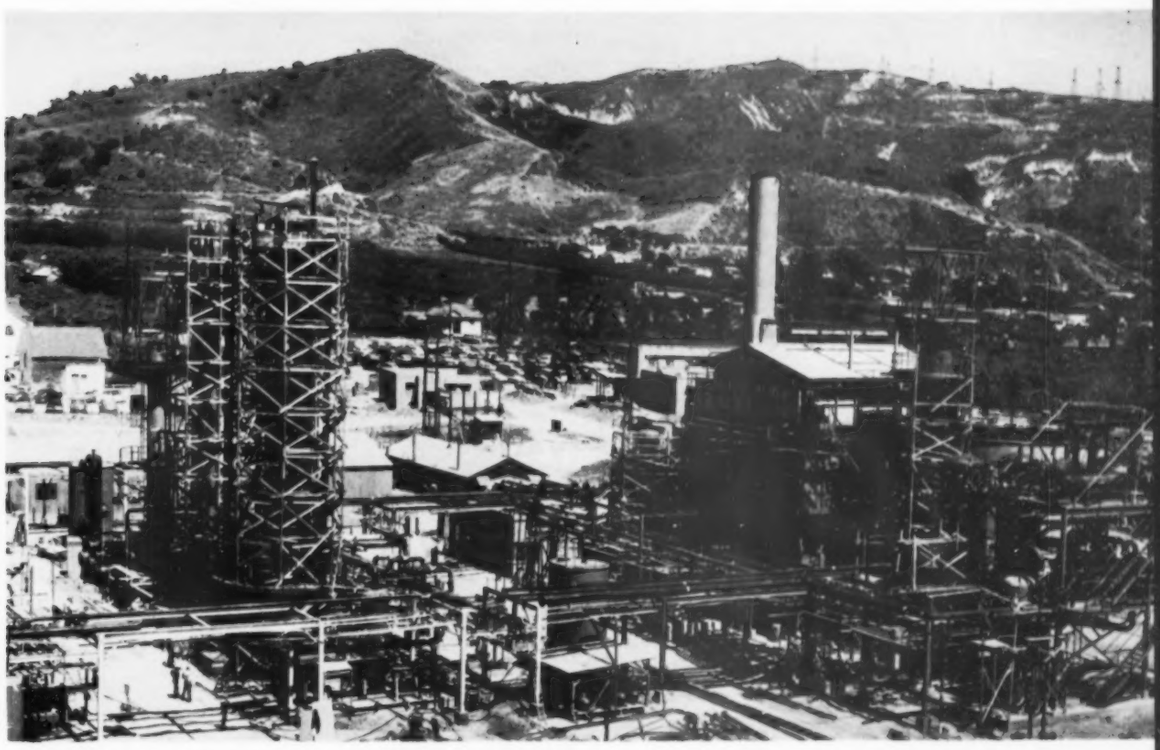
The Texas Co. is planning to round out facilities at its Eagle Point refinery at Westville, N. J., by the installation of a catalytic reformer and an alkylation plant. The reformer is to have a capacity of 11,000 b/d and the alkylation plant a



Isooctyl alcohol plant being erected by Kellogg for Standard Oil Co. (Indiana), at Wood River, Ill.



Recently completed 2,000 b/d fluid hydroformer built by Kellogg for Pan Am Southern Corp. at Destrehan, La.



Shell Oil Company is building a 150-ton ammonia plant in connection with its Ventura, Calif. refinery.

capacity of 1,750 b/d. Engineering and construction contracts have not been placed as this is written, but Texaco plans to begin construction in the third quarter of this year and complete the two jobs in about 15 months.

Upstate in New York Frontier Oil & Refining Co. in the Buffalo district is adding 5,000 b/d to crude capacity this year and building a vis breaker, a cracking stock preparation unit and a 10,000 b/d cat cracker.

Within recent months, Socony-Vacuum Oil Co., Inc. has completed a major addition to its catalytic cracking facilities at Paulsboro, N. J. The new unit which is now operating has a capacity of 18,000 b/d. Construction is in progress at Paulsboro on an addition to the former alkylation unit. A factory is being erected to manufacture catalyst for the Socony-Vacuum version of catalytic reforming. First reformers of the new type are being built at Augusta, Kans., and by General Petroleum in California. Bechtel is contractor on the Paulsboro projects. The catalyst factory is scheduled for December completion and the reformer the following month.

In the Midwest, crude charging capacity is to be increased 106,000 b/d this year and an additional 109,000 b/d in 1954. Total increase in the two-year period is 10 percent.

Standard Oil Co. (Ind.) still is in the midst of a major post-war expansion. The entire program had cost more than $1,250 million in the seven years since December 31, 1945 and the end is not in sight. Manufacturing facilities claimed 23 percent of the expansion, costing $48 million in 1952 alone.

Since the first of the year, Standard has virtually doubled the capacity of its Sugar Creek, Mo., refinery. The plant now can process 69,000 b/d of crude. At Wood River, Ill., the motor oil detergent additives plant is being expanded again. In 1952 capacity was doubled and now it is to produce six times its original capacity. Another petrochemical project at Wood River is the isooctyl plant which will process olefin concentrate from Sugar Creek.

At Whiting, Ind., the company now is producing benzene at the rate of 16 million gallons yearly. An alkymer plant has been built to produce synthetic detergents from benzene and propylene tetramer to be manufactured at El Dorado, Ark., by a subsidiary, Pan-Am Southern Corp.

Most recent Whiting petrochemical project to be announced by Standard is a plant to manufacture para-xylene. It is expected to be in operation by January 1, 1955. Anticipated production is 14,000,000 pounds per year.

The Whiting plant for separating para-xylene from the other aromatic hydrocarbons produced by hydroforming is being engineered by Badger Manufacturing Co. The operation will involve the use of the present hydroforming facilities, and is associated with Standard's production of benzene.

Most important new project of Standard at the moment is the new 30,000-barrel refinery to be built for it by The Lummus Co. at Mandan, N. D., to process Williston Basin crude. The plant is scheduled for completion in 1954.

A unique feature of the design is the combination of refinery processes into one integrated unit, running crude to base blending stocks in one operation. Fluid catalytic cracking, vapor recovery, and polymerization will be combined. The integrated unit will be located on a rectangular plot of ground, the four operations of crude distillation, fluid catalytic cracking, vapor recovery and polymerization taking place in the four corners of the rectangle. Pump rooms will be erected between the four sections and the control house.

Cities Service Oil Co. (Del.) has begun a new round of expansion and improvements at its East Chicago, Ind., refinery. The $11 million to be invested will nearly double the existing capacity. Three major units will be built: a 30,000 b/d crude topping plant, a 12,000 b/d catalytic reformer and an addition to the present 17,500 b/d delayed cokers which will about double their capacity. Arthur G. McKee & Co. will build the topping unit for Cities Service. Cooling water facilities and tankage will be expanded.

The Ohio Oil Co. has three projects under way at its Robinson, Ill., refinery. A delayed coking unit of 6,000 b/d ca-

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Oil Refineries of the World

The tabulation below has been prepared to show the present capacities and status of oil refineries outside the United States where such information is available. No data is given on U.S.S.R. plants or refineries in nations dominated by the Russians. Capacities are barrels per day. Key to type of plant: S—Skimming; L—Lubricating; A—Asphalt; C—Cracking; Comp.—Complete. Under cracking capacity to indicate type: T—Thermal; C—Catalytic.

SUMMARY OF REFINERY CAPACITIES

Operating or Operable Capacities, July 1, 1953

* Estimated

Country	No. Plants	Crude Capacity Barrels Daily	Cracking Capacity Barrels Daily
Albania *	1	3,000	.....
Argentina	17	198,820	61,520
Australia	5	21,800	.....
Austria *	9	29,910	7,340
Bahrain Island	1	180,000	41,760
Belgium	8	93,000	24,200
Bolivia	4	12,340	.....
Brazil	5	9,450	2,000T
British Borneo	1	47,600	.....
Burma	3	4,140	.....
Canada	39	475,400	207,225
Chile	3	360	.....
China	1	1,000	.....
Colombia	2	32,900	.....
Cuba	6	7,300	1,100
Denmark	3	775	.....
Ecuador	2	4,840	.....
Egypt	2	50,000	6,400
Formosa	1	18,350	4,500
France	15	492,090	42,100
Germany	32	173,200	52,400
Hungary*	8	13,000	.....
Hawaiian Islands	1	3,500	.....
India	1	10,500	2,000
Indonesia	6	198,600	41,000
Iran	3	572,100	130,000
Iraq	3	17,730	.....
Israel	1	80,000	18,000
Italy	32	282,450	1,000
Japan	16	123,440	13,600
Kuwait	1	30,000	.....
Lebanon	1	11,000	.....
Mexico	8	209,500	22,100
Netherlands	2	128,000	51,400
Netherlands West Indies	3	670,000	485,000
Norway	1	1,200	.....
Pakistan	1	4,000	1,500
Peru	3	31,750	8,000
Poland *	6	15,000	.....
Portugal	1	7,000	.....
Romania *	11	103,000	33,000
Saudi Arabia	1	189,000	.....
South Africa	1	2,000	2,000
Spain	3	38,600	3,500
Sweden	4	34,400	1,000
Switzerland	2	1,850	.....
Trieste	3	27,900	.....
Trinidad	3	115,000	35,000
Turkey	1	220	.....
United Kingdom	17	570,600	101,950
U.S.S.R.*	25	1,020,000	340,000
United States	352	7,963,000	3,019,000
Uruguay	1	25,200	2,200
Venezuela	12	411,600	59,350
Yugoslavia	3	10,500	600
Totals	697	14,777,315	4,821,685
Western Hemisphere	460	10,167,460	3,902,495
Eastern Hemisphere	237	4,609,855	919,190

Name of Company	Plant Location	Crude Capacity	Type Plant	Cracking Capacity
Albania:				
Cerzic	Tirana-Eibassan	3,000	SLA	—
Argentina:				
Cia. General Asfaltos	Wilde (B.A.)	370	L	—
Esso Refinadora de Petroleo	Campana (B.A.)	25,000	Comp.	9,000T
	Bahia Blanca	6,000	SC	2,200T
	Manuel Eloridi	1,100	S	—
	Dadin	400	S	—
Condor	Avellaneda (B.A.)	1,000	SL	—
Diadema Argentina S. A. de Petroleo	Buenos Aires[1]	18,000	SC	9,000T
La Isaura	Bahia Blanca	1,800	SC	1,000T
Loterro y Papini	Avellaneda (B.A.)	300	SL	—
Ragor S.A.	Quilmes (B.A.)	150	SL	—
Y.P.F. (Enoe)	Dock Sud-Avellaneda (B.A.)	6,000	Comp.	2,600T
	Eva Peron	105,000	Comp.	25,000T
	San Lorenzo (Santa Fe)	17,000	SC	6,200T
	Lujan de Cuyo (Mendoza)	5,000	SC	3,000T
	Chachapoyas (Salta)	1,900	SC	950T
	Plaza Huincul (Neuquen)	1,300	SC	570T
	Comodora Rividavia	5,500	SC	2,000T

[1] Reforming capacity 3,000 b/d. Lube plant for 1954 completion, capacity 600 b/d.

Australia:				
Australian Oil Refinery Ltd.	Kurnell (nr. Sydney)[1]	22,000	SC	13,000C
Bitumen & Oil Refineries Ltd.	Sydney[2]	6,500	SA	—
Commonwealth Oil Refineries Ltd.	Laverton, Victoria	3,400	S	—
National Oil Pty., Ltd.	Glen Davis (Shale Oil)	1,500	SC	—
Shell Co. of Australia Ltd.	Clyde[3]	8,400	SLA	—
Vacuum Oil Pty., Ltd. (Standard Vacuum)	Altona[4]	2,000	SLA	—

[1] Construction of the refinery scheduled to be completed 1955.
[2] 1,400 b/d platformer capacity.
[3] Capacity to be increased to 18,000 b/d 1954. 250 b/d lube plant building.
[4] Capacity to be increased 20,000 b/d.

Note: Anglo-Iranian Oil Co. to build 52,000 b/d refinery at Kwinana. Shell is building 25,000 b/d plant at Geelong, completion planned for early 1954. Process units to include 15,000 TCC unit.

Austria:				
Vacuum Oil Co.	Kargran	2,100	SLA	—
A. G. der Shell-Floridsdorfer Mineraloelfabrik	Floridsdorf	3,400	SLA	—
Oesterreichische Mineraloelwerke (Soviet)	Lobau	4,850	S	—
Benzin-Bensolverband (Soviet)	Voesendorf[1]	2,100	SLA	—
Deutsche Erdoelwerke (Soviet)	Ebensee[2]	1,860	Comp.	—
(Austrian Trusteeship)	Schwechat[1]	5,000	Comp.	3,840T
Deutsche Gasolin A.G. (Soviet)	Korneuburg[1]	4,000	S	—
Donau Oel G.M.B.H. (Soviet)	Moosbierbaum[1]	5,200	SC	3,500T
German Government (Austrian Trusteeship)	Hauskirchen[2]	1,400	S	—

[1] Located in the Austrian Federal Province of Lower Austria (Niederoesterreich), presently occupied by the Soviet Army.
[2] Located in the U. S. zone of Austria, in the Austrian Federal Province of Upper Austria (Oberoesterreich); refineries are not in operation at present.

Note: Soviet-operated refinery figures are estimate, not officially verified.

hydrocarbon in Brazil

Energy from petroleum products is basic to the expansion of the Brazilian economy. Hydrocarbon is contributing to this program

- For the Conselho Nacional do Petróleo—Comissão da Refinaria de Petróleo de Cubatão—the design and supervision of erection of the modern, completely integrated 45,000 BPD refinery at Cubatão, near the port of Santos—as pictured in construction.
- For Refinaria e Exploracão de Petróleo "União" S.A.—a private Brazilian company—the design and construction of the 20,000 BPD complete refinery now being erected at Capuava, near the city of São Paulo.

HRI

petroleum and chemical processing for profit

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115 Broadway, New York 6, N. Y.
Cable: Hydrocol

TRENTON, NEW JERSEY—Hydrocarbon Research, Inc., Development Laboratory, P. O. Box 1419.
PARIS, FRANCE—Hydrocarbon Engineering, S.a.r.L. 44, Avenue des Champs-Elysées. Cable: Hydrocarbon
DUESSELDORF, GERMANY—Hydrocarbon Mineraloel, G.m.b.H., 15-17 Fuerstenwall. Cable: Hydromin
RIO DE JANEIRO, BRAZIL—General Heitor Pedroso, Rua da Quintanda, 20, Sala 801. Cable: Bispetro.
NEW DELHI, INDIA—A. R. Palit & Company, Sujan Singh Park, Post Box 671, Cable: Palitar

Name of Company	Plant Location	Crude Capacity	Type Plant	Cracking Capacity
Bahrain Island:				
Bahrain Petroleum Co.	Bahrain[1] Persian Gulf	180,000	SCA	41,700CT[2] [3]

[1] 19,500 b/d thermal reforming capacity.
[2] 26,000 b/d fluid catalytic cracking, 15,700 b/d thermal.
[3] Modernization of catalytic cracker scheduled to be completed 1954.

Belgium:				
"Albatros" S.A. Belge pour le Raffinage de Petrole	Antwerp, Kiel[1]	3,000	S	—
Belgian Shell Co. S.A.	Ghent[2]	1,900	LA	—
Compagnie Industrielle "Atlas" S.A. (Esso)	Hoboken-Antwerp	2,100	S	—
Esso Standard Ref. S.A.	Antwerp[3]	25,000	SC	8,700C
Raffinerie Belge de Petroles	Antwerp[4]	12,000	SCA	2,000T
Raffineries et Distilleries Anversoise S.A. "Radian"	Antwerp	3,500	S	—
Soc. Industrielle Belge des Petroles S.A.	Antwerp	42,000	SC	13,500T[5]
Tankage et Transport S.A.	Antwerp[6]	3,500	S	—

[1] Construction to increase topping capacity to 11,000 b/d, catalytic cracker 4,000 b/d and poly gasoline plant, completion July 1954.
[2] Operated on topped crude.
[3] Went on stream June 15, 1953.
[4] Reforming capacity 6,000 b/d, thermal cracking unit being used as crude still.
[5] Catalytic cracker planned.
[6] New plant under construction recently, topping only.

Bolivia:				
Yacimientas Petroliferous Fiscales Bolivianos	Cechamba	5,850	S	—
	Sucre	4,630	S	—
	Camiri	1,450	S	—
	Sanandita	410	S	—
Brazil:				
Conselho Nacional do Petroleo[1]	Bahia	150	S	—
	Mataripe[2]	2,500	SC	—
Distillaria Rio Grandense de Petroleo S.A.	Rio Grande	300	S	—
Industrias Matarazzo de Energia S.A.	Sao Paulo	500	S	—
Ipiranga S.A. Cia Brazilea de Petroles	Rio Grande	6,000	SCA	2,000T

[1] Conselho is erecting a 45,000 b/d plant at Cubatao, near port of Santos, to be completed early in 1954. In March 1953 a project was approved to raise capacity to 75,000 b/d. Two years, reckoned from the date of signing the contract for the work, will be allowed for completion.
[2] Capacity of this new plant will be doubled by June 1953.

Refineraria e Exploracao de Petroleo Uniao is to build 20,000 b/d plant at Santo Andre, Sao Paulo. Planned for completion at end of 1954.

Refineraria de Petroleo de Manguinhos to build 10,000 b/d plant at Manguinhos, Rio de Janeiro, planned for completion at end of 1954.

I. B. Sabba e Companhia has been authorized to install a 2,500 b/d plant at Manaos, on the Amazon.

British Borneo:				
Sarawak Oilfields Ltd.	Lutong, Sarawak	47,000	S	—
Burma:				
Burmah Oil Co.	Chauk	2,500	Comp.	—
	Rangoon	1,000	S	—
Nathsingh Oil Co., Ltd.	Yenangyaung[1]	640	S	—

[1] Wax & lubricant plant under construction.

Chile:				
Johannsen, G. H.	Coquimbo	125	S	—
Maritano, Miguel	Talcahuano	60	S	—
Soc. Establecimientes Quimicos	Via del Mar	175	S	—

Note: Empresa Nacional del Petroleo is building a 20,000 b/d refinery with thermal cracking 5,060 b/d, and reforming facilities of 4,160 b/d, completion late 1954.

China:				
Chinese Government	Kensu	1,000	S	—

Name of Company	Plant Location	Crude Capacity	Type Plant	Cracking Capacity
Canada:				
Anglo-Canadian Oil Ltd.	Brandon, Manitoba	3,000	SC	1,375T
		Crude	**Type**	**Cracking**
British American Oil Co. Ltd.	Edmonton[1]	7,000	SCA	3,400TC
	Montreal East[2]	45,000	SCA	21,000TC
	Clarkson, Ont.[3]	17,000	SCA	4,500T
	Moose Jaw, Sask.[4]	15,000	SCA	6,000TC
	Calgary, Alberta	7,200	SCA	2,500T
Bonneyville Oil Refineries	Bonneyville	1,000	S	—
Canadian Oil Companies Ltd.	Sarnia	20,000	SC	14,000C
Excelsior Refineries Ltd.	Lloydminister	3,000	SA	—
Gas & Oil Refineries Ltd.	Hartell, Alberta	3,000	SC	1,500T
Hi-Way Refineries Ltd.	Rosetown	350	S	—
	Saskatoon[5]	5,000	SCA	1,000
	Moose Jaw	350	S	—
Husky Oil & Refining Ltd.	Lloydminister	7,500	SA	—
Imperial Oil Ltd.	Calgary	9,200	SCA	4,600T
	Edmonton	22,600	SC	9,100C
	Halifax	22,000	SCA	10,000T
	Ioco, B.C.[6]	12,000	Comp.	2,750T
	Montreal East[6]	46,000	SCA	26,000TC
	Norman Wells	1,250	S	—
	Regina[7]	20,000	SCA	17,000TC
	Sarnia	71,000	Comp.	27,000
	Winnipeg	12,000	SC	3,600C
McColl-Frontenac Oil Co. Ltd.	Montreal East[8]	43,000	SC	19,000TC
	Edmonton	5,000	SC	2,600C
Moose Jaw Refineries Ltd.	Moose Jaw, Sask.[9]	2,000	S	—
New Brunswick Oilfields Ltd.	Weldon, N.B.	300	S	—
North Star Oil Ltd.	St. Boniface, Man.	5,000	SC	1,100T
Northern Petroleum Corp. Ltd.	Kamsack, Sask.	800	S	—
Prince Albert Refineries Ltd.	Prince Albert, Sask.	1,000	S	—
Radio Oil Refineries Ltd.	East Kildonan, Man.	2,000	S	—
Refinery Operators Ltd.[10]	Coleville, Sask.	5,000	S	—
Riverlakes Oils Ltd.	Fort William	2,500	S	—
Saskatchewan Federated Cooperative Ltd.	Regina, Sask.[11]	6,500	SC	2,500T
Shell Oil Co. of Canada Ltd.	Montreal East[12]	30,000	SC	19,500TC
Shell Oil Co. of B.C. Ltd.	Shellburn, B.C.[13]	10,000	SC	3,400T
Standard Oil Co. of B.C. Ltd.	Stanovan, B.C.	8,350	SA	—
Supreme Refineries, Inc.	Ogden	1,200	S	—
Trinidad Leaseholds Ltd.	Port Credit, Ont.[14]	7,000	SC	3,600T
Wainwright Refineries Ltd.	Wainwright, Albt.	300	S	—

[1] 2,000 b/d catalytic cracking and 1,400 b/d thermal cracking.
[2] 17,500 b/d catalytic cracking and 3,500 b/d thermal cracking.
[3] Under construction: 11,000 b/d catalytic cracker, 600 b/d polymerization unit, completion 1954.
[4] 4,500 b/d catalytic cracking and 1,500 b/d thermal cracking.
[5] Under construction: 2,600 b/d UOP fluid catalytic cracker, visbreaking capacity 3,500 b/d, desulfurization of gasoline 1,600 b/d and increasing of crude capacity to 6,500 b/d, completion end of 1954.
[6] 15 500 b/d catalytic cracking and 10,500 b/d thermal cracking. Under construction: Increasing capacity to 58,000 b/d, completion in 1954.
[7] 7,500 b/d fluid catalytic cracking capacity, and 9,700 b/d thermal cracking capacity.
[8] 14,500 b/d cracking capacity, 13,800 b/d thermal cracking capacity, 4,500 b/d thermal reforming capacity.
[9] Reforming capacity 300 b/d.
[10] Under construction: 5,000 b/d plant at Coleville, completion end of 1954.
[11] Under construction: 6,500 b/d vacuum unit, 5,000 b/d catalytic cracker, high pressure gasoline plant, catalytic polymerization plant, LP Gas facilities 5,000 b/d treater for straight run gasoline, 4,000 b/d treater for cracked gasoline, completion July 1954.
[12] 11,500 b/d catalytic cracking capacity and 8,000 b/d thermal cracking capacity.
[13] Under construction: increasing capacity to 15,000 b/d, including a fluid catalytic cracker, vacuum flasher, gas recovery plant, polymerization and treating units, completion late 1953.
[14] Reforming capacity 700 b/d.
[15] Crude capacity to be increased 22,000 b/d, completion late 1953.

Colombia:				
Colombia Petroleum Co.	Petrolea	900	S	—
Tropical Oil Co.	Barrancabermeja	32,000	SLA	—
Cuba:				
Cia. Exploradora de Petroleo	Jarahueca	400	S	—
Cia. Petrolera Jarahueca	Jarahueca	600	S	—
Cuban Oil Ref. Co.	Cabaiguan	800	S	—
Destiladora Jarahueca	Santa Clara	200	S	—
Esso Standard Oil Co.	Belot	5,000	Comp.	1,100T
Union Gas Co.	Bacaranao	300	S	—

Name of Company	Plant Location	Crude Capacity	Type Plant	Cracking Capacity
Denmark:				
AA/S Kalundborg Oileraffinaderi	Kalundborg	650	A	—
Dansk Mineraloliefabrik	Copenhagen	60	SL	—
L. C. Glad & Co.	Copenhagen	65	S	—
Ecuador:				
Anglo Ecuadorian Oilfields Ltd.	La Libertad	4,190	S	—
Manabi Exploration Co.	Cautivo	650	SL	—
Egypt:				
Anglo-Egyptian Oil Fields Ltd.	Suez	41,000	SCA	6,400T
Raffinerie de Petrole du Government	Suez	9,000	SA	—
France:				
Compagnie Francaise de Raffinage	La Mede[1]	70,000	SA	14,200TC
	Gonfreville[2]	74,000	Comp.	8,600T
Compagnie de Raffinage Shell-Berre	Petit-Couronne[3]	35,000	Comp.	4,900T
	Pauillac	12,000	SA	—
	Berre[4]	68,200	Comp.	4,200C
Pechelbronn SAEM	Merkwiller	1,600	Comp.	200T
Raffineries Francaises de Petrole de l'Atlantique	Donges[5]	34,590	S	—
Raff. de Petrole de la Gironde	Bec d'Ambes[6]	16,500	S	—
Ste. Cherifienne des Petroles	Petitjean (Morocco)[7]	2,200	S	—
Ste. Generale des Huiles de Petrole	L'Avera	42,000	SA	—
	Dunkerque[8]	42,000	Comp.	—
Socony Vacuum Francaise	N. Dame de Gravenchon	17,500	Comp.	—
	Frontignan	25,000	SC	10,000C
Standard Francaise des Petroles	Port Jerome[9]	51,000	Comp.	—
	La Mi illeraye	500	[10]	—

[1] Catalytic cracking capacity 12,000 b/d, thermal cracking capacity 2,200 b/d, thermal reforming capacity 10 200 b/d. Under construction: polymerization unit, completion late 1953.

[2] Thermal reforming capacity 9,600 b/d.

[3] Thermal reforming capacity 3,500 b/d.

[4] Thermal reforming capacity 11,300 b/d. Under construction: 8,000 b/d catalytic cracking unit.

[5] Thermal reforming capacity 3,780 b/d. Catalytic cracking plant planned for construction.

[6] Thermal reforming capacity 6,500 b/d.

[7] Under construction: TCC catalytic cracking unit, completion January 1954.

[8] Thermal reforming capacity 6,600 b/d. 6,000 b/sd Platformer in design.

[9] Thermal reforming capacity 5,500 b/d. Under construction: 10,000 b/d catalytic cracker, completion late 1953 and 25,000 b/d pipestill, completion July 1954.

[10] Medicinal and technical white oils, greases and special products.

Hawaiian Islands:				
Pacific Refiners, Ltd.	Honolulu, Oahu[1]	3,500	SA	—

[1] Operates on reduced crude and butane.

Hungary:

In the absence of official information, recent estimates indicate a total of 8 refineries in Hungary with a daily crude capacity of 22,000 barrels.

India:				
Assam Oil Co.	Digboi[1]	10,500	Comp.	2,000T

[1] Under construction: gasoline plant, completion August 1953 and two-stage lub. base distillation unit, completion July 1954.

Note: Shell Caltex and Standard-Vacuum interests are planning erection of large refineries. Shell plant at Bombay to have capacity of 40,000 b/d, Standard plant capacity will be 25,000 b/d. Caltex plant at Vishakapatnam to have a capacity of 10,000 b/d.

Name of Company	Plant Location	Crude Capacity	Type Plant	Cracking Capacity
Formosa:				
Chinese Petroleum Corp.	Kaoshiung, Taiwan	18,350	SCL	4,500T
Germany:				
Badische Anilin- & Soda-Fabrik	Ludwigshafen-on-Rhine	1,000	SL	—
BP Benzin-und Petroleum-GmbH. (Anglo-Iranian)	Hamburg-Finkenwerder[1]	15,000	SC	4,900T
Coelner Benzin-Raffinerie	Cologne	320[2]	[3]	—
Deutsche Erdoel-AG.	Heide	6,000	SLA	6,000C
	Wietze	1,000	LA	—
	Hamburg-Grasbrook	1,500	L	—
Deutsche Gasolin A.G.	Dollbergen-Lehrte	2,330	Comp.	—
Deutsche Shell A.G.	Hamburg-Barburg	9 600	SLA	—
	Monheim on Rhine	4,000	SLA	—
	Hamburg-Grasbrook	1,700[2]	L	—
	Duesseldorf-Reisholz	900[2]	[3]	—
	Hamburg-Wilhelmsburg	850[4]	[3]	—
Deutsche Vacuum Oel A.G.	Bremen-Oslebshausen	15,000	Comp.	8,000C
	Wedel on Elbe	750[2]	L	—
Esso A.G. (Standard Jersey)	Hamburg-Harburg[5]	13,000	SLA	—
Gelsenberg Benzine A.G.	Gelsenkirchen	28,000	SH	9,200[6]
Gewerkschaft Deurag-Nerag	Misburg n. Hannover[7]	10 000	Comp.	4,200T
George Greiser/Pfeiffer	Dollbergen	500	SL	—
Johann Haltermann	Hamburg-Wilhelmsburg	2,100[2]	[3]	—
Kraftstoff-Handelsgesellschaft mbH.	Essen	750	S	—
Mineraloel-und Asphaltwerke A.G. (MAWAG)	Ostermoor on Kiel Canal	2,000	SA	—
Mineraloewerke Albert Sengewald	Dedenhausen (Hannover)	900	SL	—
Mineraloelwerke Peine (Schindler)	Peine (Hannover)	380	SL	—
Mineraloelwerke Albrecht & Co.	Hamburg-Grasbrook	250[2]	L	—
Oelwerke Julius Schindler GmbH.	Hamburg-Neuhof	4,300	SL	—
Ruhrbau GmbH.	Muelheim on Ruhr	4,300	S	—
Ruhrchemie, A.G.	Oberhausen-Holten	5,400	S	—
Ruhroel GmbH.	Bottrop[1]	2,700	S	—
Schloven-Chemie A.G.	Gelsenkirchen-Buer	8,500	SH	5 100[6]
Union Rheinische Braunkohlen Kraftstoff A.G.	Wesseling n. Cologne	28,000	SCH	9,000T 6,000[6]
Wintershall A.G.	Salzbergen (Emsland)	2,000	L	—
Zeller & Gmelin	Eislingen (Wuerttemberg)	170	SL	—

[1] Reforming capacity 4,000 b/sd. Under construction: 15,000 b/sd crude oil distillation unit, and 6,000 b/sd reforming unit.

[2] Half finished products charging capacity.

[3] Type of plant gasoline rerunning.

[4] Under construction: 21,000 b/d crude oil charging unit, catalytic cracking unit and naphtha reforming unit, completion January 1954.

[5] Intake capacity for hydrogenation, H-hydrogenation.

[6] Thermal reforming capacity 2,500 b/d.

[7] Thermal reforming capacity, 2,500 b/d. Planned: reconstruction of the hydrogenation unit and construction of catalytic cracking unit with capacity of 5,500 b/d and a 5,500 crude oil charging unit.

Indonesia:				
N.V. de Bataafsche Petroleum Mij. (Shell)	Balik Papan, N.E. Borneo	46,000	SW	—
	P. Brandan, Sumatra[1]	—	—	—
	Paladju, Sumatra[2]	83,000	SC	10,000T
	Tjepu, Java	3,600	S	—
	Wonokroma, Java	2,000	SA	—
N.V. Standard Vacuum Petroleum Mij.	Palenbang, Sumatra	64,000	Comp.	31,600T

[1] Inaccessible, former capacity 23,000 b/d.

[2] Reforming capacity 15,000 b/d.

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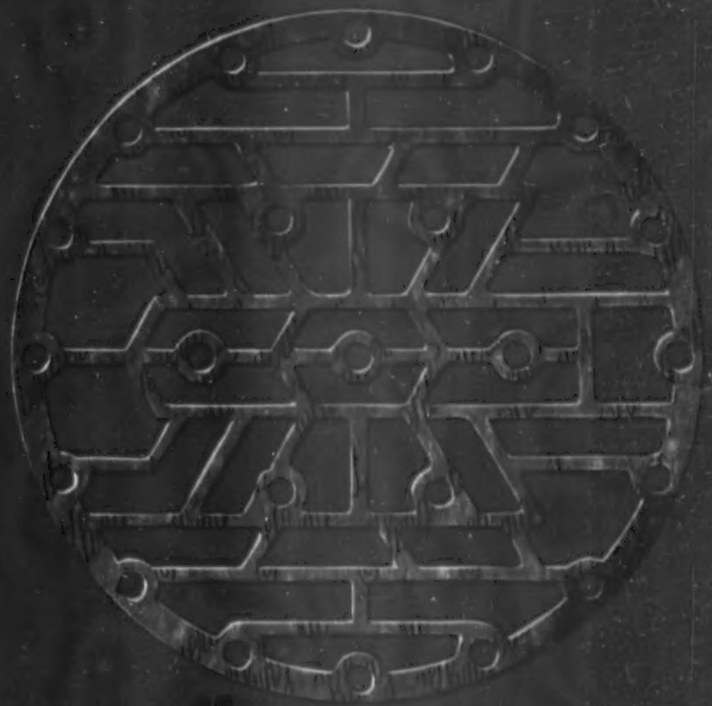

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Name of Company	Plant Location	Crude Capacity	Type Plant	Cracking Capacity
Iran:				
Anglo-Iranian Oil Co.[1]	Abadan	500,000	Comp.	130,000CT
	Kerminshah	2,100	S	—
	MIS[2]	70,000	T	—

[1] Refineries now under control of Persian government.

[2] Crude topping plant for Abadan refinery; makes no finished products, ships tops or bottoms to Abadan by pipe line as required for finishing.

Iraq:				
Iraq Petroleum Co.	Bab Gurgur	2,900	S	—
Kanaquin Oil Co. Ltd.	Alwand[1]	11,400	S	—
	Basrah[1]	3,430	S	—

[1] Refineries property of the Iraq Government operated by Kanaquin Oil Co., Ltd. Construction has been begun at Beiji of a 24,000 b/d refinery for the Iraq Government.

Italy:				
Anonima Petroli Italian (API)	Falconara	14,000	S	—
Asfalti Bitumi-Catrami e Derivati (ABCD)	Ragusa, Sicily	100	A	—
Aurora	Marghera, Venice	400	S	—
Bianchi Petroli	Cologno Monzese	1,000	S	—
Condor[1]	Rho	15,000	S	—
Delle Piane	Genoa	1,000	S	—
Distilleria Italiana Catrami Affini (DICA)	Carrara	3,000	S	—
Galletti	Florence	3,500	S	—
Garrone	Genoa	5,700	S	—
Industria Raffinazione Oli Minerali (IROM)	Marghera, Venice	30,000	SC	1,000T
I.C.I.P.	Mantova	300	S	—
Idrocarburi Nazionali (SIN)	Pietramala, Florence	250	S	—
I.P.L.O.M.	Genoa	1,000	S	—
I.L.S.E.A.	Valmadrera, Como	2,000	S	—
I.N.P.E.T.	La Spezia[2]	30,000	SA	—
Industria Nazionale Oli Lubrificanti (NILO)	Milan	500	S	—
Lombarda Petroli	Villasanta, Milan	5,500	S	—
Permolio	Genoa	5,000	SAC	—
	Milan	5,000	SLA	—
	Rome	5,000	SAC	—
Petroli d'Italia	Fiorenzuola d'Arda, Parma	4,500	S	—
Raffineria Siciliana Oli Minerali (RASIOM)	Augusta, Sicily	10,000	S	—
Raffineria Oli Lubrificanti (ROL)	Viguzzolo, Alessandria	1,400	SL	—
Socony-Vacuum	Naples	70,000	SL	—
Sanquirico	Genoa	1,000	S	—
SA.R.O.M.	Ravenna	12,000	S	—
S.A.R.P.O.M.	Trecate, Novara[3]	13,300	S	—
S.P.I.	Fornovo Taro, Parma	1,000	S	—
STANIC	Bari	21,000	SA	—
	Leghorn	17,500	Comp.	—
S.T.O.I.	Florence	2,000	S	—
Volpato	Milan, Italy	500	S	—

[1] Completion probably before December 1953.

[2] 1,600 b/d thermal reforming capacity.

[3] 3,150 b/d thermal reforming capacity.

Mexico:				
Petroleos Mexicanos	Arbol Grande, Tampico	19,000	SLA	—
	Atzacapotzalco, D. F.[1]	49,000	S	12,300T
	Ciudad Madero, Tampico[2]	62,000	A	1,000T
	Mata Redonda, Vera Cruz	14,000	S	5,000T
	Minatitlan, Vera Cruz[3]	27,000	SL	—
	Poza Rica, Vera Cruz	7,500	S	—
	Reynosa, Tampico[4]	4,000	S	—
	Salamanca, Gto.[5]	27,000	S	3,800T

[1] Under construction, 30,000 b/d topping unit, 8,000 b/d catalytic cracking unit, feed preparation and alkylation, probable completion late 1957.

[2] Under construction, 20,000 b/d secondary distillation unit, 20,000 b/d catalytic cracking, charge preparation and polymerization units, probable completion late 1955. Reforming capacity 5,000 b/d.

[3] Under construction, 30,000 b/d topping unit, 9,000 b/d catalytic cracking, charge preparation and polymerization units, probable completion late 1955.

[4] Revamping present facilities to 10,000 b/d, probable completion early 1954.

[5] Under construction, lube oil facilities for the production of 2,600 b/d lubricants and 65 tons wax, probable completion early 1955.

Name of Company	Plant Location	Crude Capacity	Type Plant	Cracking Capacity
Israel:				
Consolidated Refineries Ltd.	Haifa[1]	80,000	SCA	18,000T

[1] Thermal reforming capacity 17,000 b/d.

Japan:				
Daikyo Oil Co.	Yokkaichi[1]	10,000	SLA	—
Koa Oil Co.	Marifu	10,000	Comp.	1,400T
Maruzen Oil Co.	Shimotsu[2]	11,500	Comp.	—
	Matsuyama	1,000	S	—
Mitsubishi Oil Co.	Kawasaki[3]	11,240	SLAC	7,400T
Nippon Mining Co.	Funakawa	3,000	SLAC	—
Nippon Oil Co.	Akita[4]	4,000	SLA	—
	Kashiwasaki	1,500	SLA	—
	Niigata[5]	2,000	Comp.	—
Nippon Pet. Ref. Co. Ltd.	Yokohama[6]	17,500	Comp.	—
	Kuadamatsu[7]	8,500	Comp.	—
Showa Oil Co.	Kawasaki	11,900	SLA	1,300C
	Hirazaua[8]	3,000	SLA	—
	Niigata	5,800	SLA	—
Toa Nenryo Kogyo Co.	Shimizu	7,500	SLA	—
	Wakayama[9]	15,000	Comp.	3,500T

[1] Catalytic cracking unit and polymerization plant being planned.

[2] 3,000 b/d catalytic cracker under construction, completion early next year.

[3] Under construction, MEK dewaxing, W/Wax fractionation, furfural extraction, Platforming topping, contact clay treating units. Planned, catalytic cracker.

[4] 1,000 b/d thermal cracking unit under construction, completion end of this year.

[5] TEL blending and gasoline plant under construction, completion end of this year.

[6] Modernization and expansion program, including construction of a catalytic cracker is scheduled for 1954/55 completion.

[7] 1,200 b/d platformer scheduled to be completed in 1954.

[8] Shut down in 1952.

[9] 1,300 b/d propane dewaxing unit is under construction, completion end of 1953.

Korea:

Plant Destroyed

Kuwait:				
Kuwait Oil Co. Ltd.	Mina Al Ahmadi, Persian Gulf[1]	30,000	S	—

[1] Asphalt plant, 500 b/d completed April 1953.

Lebanon:				
Iraq Petroleum Co. Ltd.	Tripoli	11,000	S	—

Caltex building refinery at Sidon, Lebanon, with a crude capacity of 6,250 b/d and a 5,600 b/d Platformer.

Netherlands:				
N.V. de Bataafsche Petroleum Mij. (Shell)	Pernis[1]	100,000	Comp.	45,000TC[2]
Caltex Petroleum Mij. N.V.	Pernis[3]	28,000	SC	6,500T

[1] Under construction: crude capacity being increased 165,700 b/d, completion late 1953; extension of luboil refinery to 1,750 b/d, completion early 1955; solvents plants 16,000 tons per annum, completion May 1954.

[2] Thermal 20,000 b/d, catalytic 25,000 b/d, reforming capacity 8,500 b/d.

[3] 6,500 b/d thermal reforming capacity.

Netherlands West Indies:				
N.V. Curacaosche Petroleum Industrie Mij.	Aruba[1]	30,000	S	—
	Curacao[2]	200,000	Comp.	100,000T
Lago Oil & Transport Co. Ltd.	Aruba[3]	440,000	Comp.	385,000TC[4]

[1] Refinery now closed down.

[2] Extending luboil refinery to 2,100 b/d, completion early 1954. Reforming capacity 18,000 b/d.

[3] Under construction sulfur recovery facilities.

[4] Catalytic cracking capacity 40,000 b/d, thermal cracking capacity 345,000 b/d, reforming capacity 18,000 b/d.

Norway:				
A/S Ozlandske Petroleums Compagni	Valloy per Tonsberg	1,200	Comp.	—

Pakistan:				
Attock Oil Co.	Punjab, Rawahlpindi	4,000	Comp.	1,500T

Philippine Islands:

Caltex building a refinery at Batangas with a crude capacity of 13,000 b/d, and a catalytic cracking capacity of 5,400 b/d to be completed in 1955.

HIGHLIGHTS OF THE FIRST SIX MONTHS OF 1953

FROM— CHEMICAL PROCESS NEWS / REFINERY PROCESS NEWS

Cascade Reactor, Recently Introduced, Is Highly Successful in Alkylation Plants

For example, two years ago Kellogg brought out its new cascade reactor for sulfuric acid alkylation. Peculiar only to Kellogg designs, this reactor provides a most desirable high ratio of iso-butane to butylene without the additional expense of extensive iso-butane recycling equipment required in conventional plants. In addition, the overall plant design maint[ains] acid consumption [possible] [auto]- [in]-

Three of these new reactor designs have now been put into service. A fourth will be the heart of a contract for the design and erection of a new plant in a Rocky Mountain refinery. Experience with the novel reactors, which have undergone even further refinements since the first was installed two years ago, has shown exceptionally

Sinclair-Baker Catalyst Promises Substantially Lower Operating Costs and Increased Yields

Employing the recently announced Sinclair-Baker platinum catalyst—a joint development of Sinclair Research Laboratories, Inc. and Baker & Company—Kellogg's new catalytic reforming process is expected to produce excellent yields of high [octane] product from a wide variety

tive type and has two major advantages over existing commercial platinum catalysts: (a) the catalyst maintains high activity over considerably longer periods of time, resulting in substantially lower catalyst operating costs, and (b) it has a greater ability to convert low octane paraffinic components to high octane aromatics.

Simple Change in Orthoflow Unit Radically Reduces Catalyst Loss!

A comparatively simple modification in the regenerator of the first domestic Orthoflow unit has radically reduced amount of catalyst lost with stack gases. Tests over a period of better than two months prove that the catalyst loss factor of the Orthoflow is now [one] that of the best side-by-side [unit]. [Gasoline] yields from this [unit] the best

First Model "B" Orthoflow Unit Completed Soon

Shown here as it passed the 75%-completion point is the first of the new type Orthoflow Fluid catalytic crackers. It is currently about to be placed on stream at a major Midwestern refinery.

Known as the Model "B" Orthoflow, it is a variation of the original Orthoflow design. Principal reason for the new design, with the regenerator above the reactor, is the expected reduction in the operating costs in comparison with the conventional Model "A" [units] of which are now [operating]

Lower Initial Investment, Decreased Operating Cost with New Urea Process

A new, low-cost method of producing synthetic urea of exceptional purity from ammonia and carbon dioxide is now available in the United States through Kellogg. Known as the Montecatini Urea Process—after the well-known Italian firm which developed it—the method reflects more than 30 years of experience in nitrogen chemistry.

[Outstanding] [features] of the Montecatini process is the reduction in operating cost due to the virtual elimination of the corrosion problems generally associated with urea synthesis. This is accomplished not only through judicious materials selection but also through the use of relatively mild operating conditions in the reaction zone in comparison with other [urea processes]

Capital Investment Lowered in Phthalic Anhydride Plants

Several design improvements which lower capital investment are being incorporated in new Fluid phthalic anhydride plants now underway for two major chemical companies abroad.

Most important is a re-design of the condensing system which not only reduces capital investment but also improves operating conditions. For example; it precludes any need for operators to come in direct contact with the phthalic or its fumes.

When completed the two new plants will produce about 50 million pounds [annually]

New Sulfur Removal Process Promises Maximum Oil Yield

Because of the increasing volume of high sulfur crudes being produced, many refiners have shown considerable interest in the new desulfurization process—Autofining—which has been developed and commercially tested by the Anglo-Iranian Oil Company, Ltd.

The Autofining process—licensed on a world-wide basis by Kellogg—has several advantages over [conventional] acid [treating]

High Pressure Gas Reforming Slated for West Coast Ammonia Unit

A special high-pressure gas reforming plant will be the feature of a new ammonia plant Kellogg is currently erecting for a West Coast processor. Shown here during construction, the unit will produce well over 300,000 pounds of anhydrous ammonia daily from a natural gas feed stock.

The result of pilot plant studies by Kellogg, the reformer section of the plant makes use of the fact that natural gas is usually [available] high pressure. Rather than design the reformer for operation at conventional low pressure and thus produce low pressure synthesis gas, Kellogg engineered this section to conserve the potential energy of the natural gas. Although the synthesis gas must be still further compressed before it is charged to the converter, the new high pressure reformer will save about 25% to 35% on compressor [horsepower]

Changing Product Economics Increases Interest in Delayed Coking Process

In view of the deteriorating market for residual fuel oil in certain areas and no indications that it will greatly improve in the future, refiners in many parts of the country are reaching the decision that a coking step is the most logical solution to this economic problem.

Not only has the moderate winter piled up supplies of residuals in [storage] of the country but

Petroleum coke is marketable today in virtually every part of the country — in contrast with the situation a few years ago when it had value only as refinery fuel in a number of locations. Further its price ranges as high as $10 a ton or more, depending on quality. In addition to customary uses, there is an increasing demand for petroleum coke in the manufacture of the carbon electrodes used in aluminum [production]. Roughly seven- [barrels of petroleum] [coke] one

Greatly Reduced Coking and Improved Yields in Kellogg's Unique Ethylene Process; New Pyrolysis Method Adaptable to Ethane

Whereas conventional ethylene pyrolysis furnaces usually average only a few weeks on-stream before being shut down for coke removal, this plant showed only slight coke deposits when inspected after 12 months continuous operation. During this period it was operated with sufficient severity to convert 55 to 60 wt. % of the naphtha to C-4's and lighter gaseous products.

Meanwhile continuing pilot plant studies are being carried out in the Kellogg labs on using various adaptations of this pyrolysis process to produce high purity ethylene from ethane, propane and other feed stocks. Test runs indicate that the Kellogg method will produce higher yields of ethylene and less coke than conventional processes.

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KELLOGG PULLMAN

Name of Company	Plant Location	Crude Capacity	Type Plant	Cracking Capacity
Peru:				
Cia. de Petroleo Ganzo Azul	Agua Caliente	750	S	—
Empresa Petrolera Fiscal	Zorritos	1,000	S	—
International Petroleum Co.	Talara[1]	30,000	Comp.	8,000T
[1] Construction in progress to increase capacity to 45,000 b/sd, completion by July 1954.				
Poland:				
In the absence of official data, it is estimated that there are 6 refineries in Poland with a current crude capacity of 8,500 barrels daily.				
Romania:				
In the absence of official information, estimates indicate that there are 11 refineries in Romania with a current crude capacity of 103,000 barrels daily.				
Portugal:				
"Sacor" S.A. Concessionaria de Refinacao de Petroleos em Portugal	Cabo Ruivo[1]	7,000	S	—
[1] Plant under reconstruction. Increasing crude capacity to 25,000 b/d, building catalytic cracking unit with capacity of 8,000 b/d and polymerization unit. Completion date early 1954.				
Saudi Arabia:				
Arabian American Oil Co.	Ras Tanura[1]	189,000	AS	—
[1] Naphtha reforming capacity 25,000 b/d, Phosphoric acid catalytic polymerization unit capacity of 900 b/d, fluid hydroforming 12,500 b/d to be completed late 1954.				
South Africa:				
So. Africa Torbanite Mining & Refining Co.	Boksburg N. Transval	2,000	SCA	2,000T
Standard Vacuum Ref. Co. of So. Africa Pty. is building 25,000 b/d refinery at Durban.				
Spain:				
"Campsa" Cia. Arrandetaria del Monopolio de Petroleo S.A.	Barcelona	300	SL	—
"Cepsa" Cia. Espanola de Petroleo S.A.	Canary Islands[1]	25,000	Comp.	3,500T
Refineria de Petroles de Escombreras, S.A.	Escombreras[2]	13,300	S	—
[1] 10,000 b/d topping plant, 5,000 b/d Platforming unit, 500 b/d Udex unit under construction, completion mid 1954.				
[2] Thermal reforming capacity 9,000 b/d.				
Sweden:				
AB-Nymas Petroleum	Nynashamm	12,000	Comp.	1,000T
	Malmo	1,900	A	—
Koppartrans Oljeaktiebolag	Goteborg[1]	18,000	S	—
Svenska, Skifferolje A/B	Narkes-Kvarntorp[2]	2,500	S	—
[1] Reforming capacity 1,900. Increasing crude distillation capacity to 25,000 b/d. Increasing reforming capacity to 4,800 b/d.				
[2] Shale oil plant.				
Turkey:				
Maden Tetkik ve Arama Enstituso	Batman[1]	220	S	—
[1] A refinery of 6,250 b/d capacity including thermal cracking and naphtha reforming units under construction.				
Uruguay:				
Administration Nacional de Combustibles, Alcohol y Portland (ANCAP)	Montevideo	25,200[1]	SCA	2,200
[1] This capacity consists of two topping units and a cracking unit. The 25,200 b/d includes both topping units and the cracking unit which is adapted for distillation of crude oil. When only the topping units are in operation, crude dist. capacity of the refinery is about 16,000 b/d.				
Yugoslavia:				
Government	Rijeka	7,000	SLAC	600
	Sisak	2,000	S	—
	Bosanski Brod	1,500	S	—
U.S.S.R.:				
The government has announced an increase in capacity during 1952 of 100,000 b/d. It is estimated that crude capacity now approximates 1,020,000 b/d, cracking capacity 340,000 b/d.				

Name of Company	Plant Location	Crude Capacity	Type Plant	Cracking Capacity
Switzerland:				
Ipsa A.G.	Rotkreuz[1]	1,500	S	—
Schweiz-Sprengstoffabrik A.G.	Dottikon[2]	350	—	—
[1] Operates on tops.				
[2] Manufactures special naphthas.				
Trieste:				
Aquila S.A. Tecnico Industriale	Trieste[1]	20,000	SCL	—
Esso Standard	Trieste	7,400	SLA	—
I.R.C.O.	Trieste	500	S	—
[1] Catalytic cracker under construction, to be completed 1955.				
Trinidad:				
Brighton Terminal Ltd.	Brighton	5,000	S	—
Trinidad Leaseholds Ltd.	Point-a-Pierre[1]	80,000	Comp.	35,000TC
United British Oilfields of Trinidad, Ltd.	Point Fortin	30,000	SA	—
[1] 25,000 b/d reduced crude thermal cracking, 10,000 b/d naphtha reforming, 15,000 b/d fluid cat cracker with vacuum feed preparation unit and visbreaker under construction. Sulfur plant under construction also.				
Venezuela:				
Creole Petroleum Corp.	Amuay Bay[1]	60,000	S	—
	Caripito	57,000	SC	25,000T
Mene Grande Oil Co.	Oficina	300	S	—
Phillips Oil Co.	Santa Ana	3,000	Wax	—
Shell: Colon Development Co. Ltd.	Casigua	1,000	S	—
	La Rivera	300	S	—
	El Calvario	300	S	—
Shell-Caribbean Petroleum Co.	San Lorenzo	44,700	S	—
	Cardon	145,000	Comp.	25,000T
Sinclair Oil & Refining Co.	Puerto La Cruz[2]	35,000	S	—
Texas Petroleum Co.	Tucupita	10,000	S	—
Venezuela Gulf Refining Co.	Puerto La Cruz[3]	55,000	SC	9,350T
[1] Capacity is being increased to 150,000 b/d.				
[2] Gasoline stabilization unit under construction.				
[3] Handles Mene Grande and Texas company crudes.				
United Kingdom:				
Anglo-Iranian Oil Co. Ltd.	Isle of Grain, Kent[1]	80,000	Comp.	10,000C
Berry Wiggins & Co. Ltd.	Kingsmouth on the Medway nr. Rochester, Kent[2]	2,000	SLA	—
	Salford	1,500	SLA	—
Briggs & Co. Ltd., Wm.	Dundee, Scotland	1,000	SLA	—
Carless, Capel & Leonard	London	200	S	—
Esso Petroleum Co. Ltd.	Fawley[3]	140,000	Comp.	41,000C
Lobitos Oil Fields Ltd.	Ellesmere Port	2,700	Comp.	750T
London & Thameshaven Oil Wharves Ltd.	Thameshaven	2,000	LA	—
Manchester Oil Refinery Ltd.	Trafford Park[4]	3,500	Comp.	—
National Oil Refineries Ltd.	Llandarcy, S. Wales[5]	80,000	Comp.	12,000C
Scottish Oils Ltd.	Grangemouth[6]	55,000	SC	12,500C
	Pumpherston, Scot.	7,000	SC	1,200T
Shell Refining & Marketing Co. Ltd.	Ardrossan, Scot.	1,700	A	—
	Shell Haven, Essex[7]	60,000	Comp.	—
	Stanlow, Ellesmere Port[8]	85,000	Comp.	25,000C
	Heysham, Lancs.[9]	33,000	S	—
Vacuum Oil Co. Ltd.	Coryton, Essex[10]	16,000	Comp.	—
[1] TCC Lube oil plant under construction, completion end of 1953, 6,000 b/d Platformer under construction, completion end of 1954.				
[2] New two-stage distillation unit 2,100 b/d due for completion November 1953.				
[3] Thermal reforming capacity 6,000 b/d. Whole refining program scheduled for completion October 1953.				
[4] New distillation unit completed and on stream.				
[5] Platforming unit to be erected, completion end of 1954.				
[6] Catalytic polymerization and sulfur recovery plant planned.				
[7] Reforming capacity now 8,500 b/d.				
[8] Reforming capacity now 8,500 b/d. Platforming unit erection nearly complete.				
[9] Reforming capacity 5,100 b/d, vis breaking capacity 8,300 b/d.				
[10] Atmospheric distillation unit and reforming unit 2,500 b/d completed and on stream, rest of plant up to schedule in erection.				

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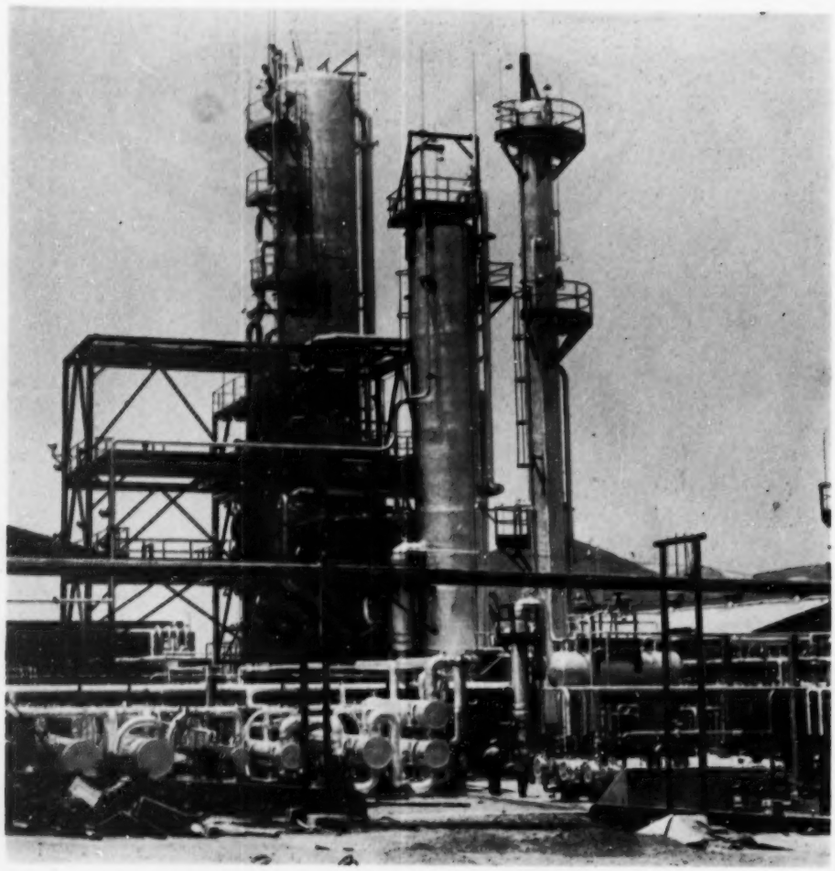


Two-stage unit erected by Foster-Wheeler Corp. for Refineria de Petroleos de Escombreras, S.A., Cartagena, Spain.

Worldwide Expansion of Refining

(Continued from page 81)

under a contract recently concluded between that company and the Indian government. A daily capacity of 10,000 barrels is tentatively proposed and the location is to be at Vishakapatnam. Under the contract, construction must begin in 1955.

Pakistan likewise is to have a second refinery built by Burmah Oil Co. under agreement with the government.

Turkey is to join the ranks of nations with a refining industry, having entered into a contract with the Ralph M. Parsons Co. for construction of a processing plant and supplying pipe line at Batman in the far eastern district of the country near the small fields of Raman and Garzan. The plant is to have a daily capacity of 6,250 b/d and the project represents a cost of approximately $8 million. Construction is about to begin with completion scheduled for late 1954.

The refinery will incorporate the latest type Thermofor catalytic cracking unit, and will manufacture motor gasoline, kerosine, diesel fuel, jet fuel, fuel oil and asphalt. The fuel oil will be used by the Turkish railroads, while the asphalt will go to the Turkish highway system.

On the continent of Europe, aside from the countries covered by other articles in this issue, a new distillation plant of 65,000 b/d capacity is being erected and is now about ready to go on stream at the Bataafsche Petroleum Company's refinery at Pernis, Holland. An extension to the lube oil refinery with an output capacity of 1,750 b/d is under construction and due for completion early in 1955. A solvents plant with an output capacity of 16,000 tons per annum is under construction and scheduled for completion in May 1954.

The refinery of Societe Industrielle Belge de Petroles (Anglo-Iranian-Fina) in Antwerp, Belgium began operating in 1952 and now has an average throughput of 42,000 b/d. The throughput is to be increased to about 60,000 b/d by partial conversion of the thermal cracking plant to atmospheric distillation, while other sections of the plant will be converted to vacuum distillation for treating the residue from atmospheric distillation for the production of feed stock for a new 10,000 b/d catalytic cracking plant, and a new catalytic polymerization plant.

In order to deal with this increased production, the offsite facilities are to be extended and additional storage of 160,000 cubic meters will be built.

Construction of the Esso refinery at Antwerp is practically complete and the plant is scheduled to go on stream in July. This will bring the capacity to 25,000 b/d.

"Albatros" S.A. is installing in its Antwerp refinery catalytic cracking and polymerization units. The work is engineered by the Houdry Process Corp. and completion is expected by July 1954.

"Sacor" S.A. is expanding its plant near Lisbon, Portugal, to a daily capacity of 25,000 barrels with completion set for 1954.

The Spanish refinery at Escombreras, jointly owned by Cepsa and Caltex, having raised its crude capacity to 30,000 b/d, is now planning to add furfural dewaxing and acid treating units and to build a lube oil plant in 1955.

In the Canary Islands, Cia. Espanola de Petroleos is increasing its thermal cracking capacity and adding a 5,000 b/d Platformer and a 500 b/d Udex unit in 1954.

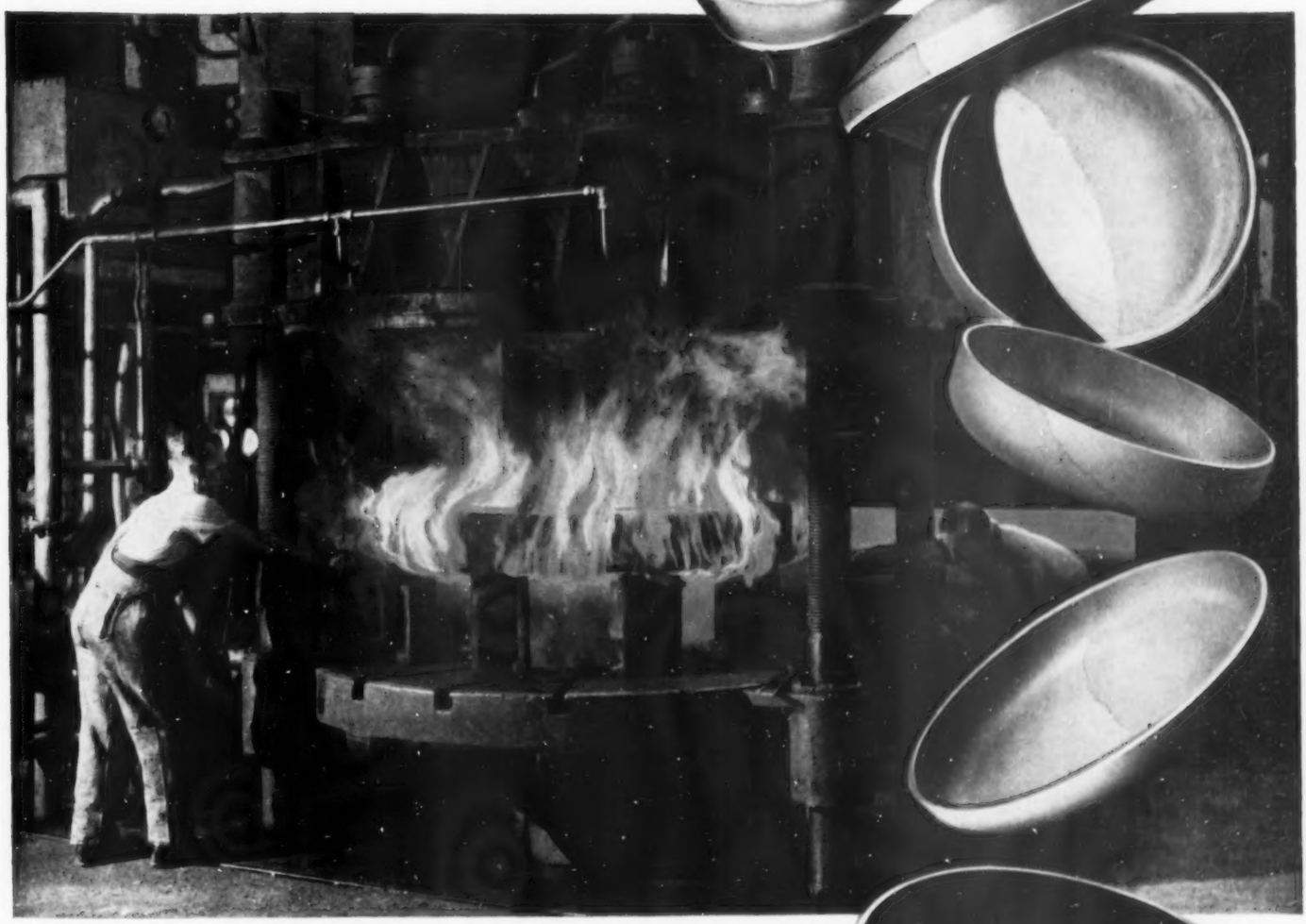
In Goteborg, Sweden, addition to the plant of Koppartrans Oljeaktiebolag will raise its crude capacity to 25,000 b/d. Thermal cracking capacity will be enlarged to 4,800 b/d and a copper sweetening unit will be erected.

In the Pacific area, where extensive additions to refining facilities have been made during the past few years, activity continues at a high level. Japanese refiners, freed from military control, have been busily improving their plants. Nippon Oil Co. has raised the charging capacity of its Yokohama refinery to 17,500 b/d and is installing a 5,600 b/d catalytic cracker and a 5,000 b/d vacuum distillation unit besides decarbonization and dewaxing units. At Akita the same company is adding a thermal cracking unit of 1,000 b/d capacity and at Niigata blending and gasoline treating units are being installed. At Kudamatsu a Platforming unit is under construction. Maruzen Oil Co. is adding a 3,000 b/d fluid cracking unit to its Shimotsu plant to be completed next year. Toa Nenro Kogyo is completing a propane dewaxing unit at Wakayama and is planning a fluid hydroforming unit. Daikyo Oil Co. is installing a Houdriflow catalytic cracker at Yokkaichi and Mitsubishi Oil Co. is adding a number of processing units to its plant at Kawasaki.

In the field of new construction in the Pacific, an outstanding development is the building of a Caltex refinery in Batangas in the Philippines. Site clearing has been completed and construction of the refinery proper is about to begin. The plant is designed for a crude charging capacity of 13,000 b/d and a cracking capacity of 5,400 b/d. Construction is planned for completion in 1955.

Elsewhere in the Pacific, Sarawak Oilfields Ltd. has raised its charging capacity from 42,000 b/d to 47,000 b/d by rearrangement and minor improvements of its equipment.

DISHED ENDS ?



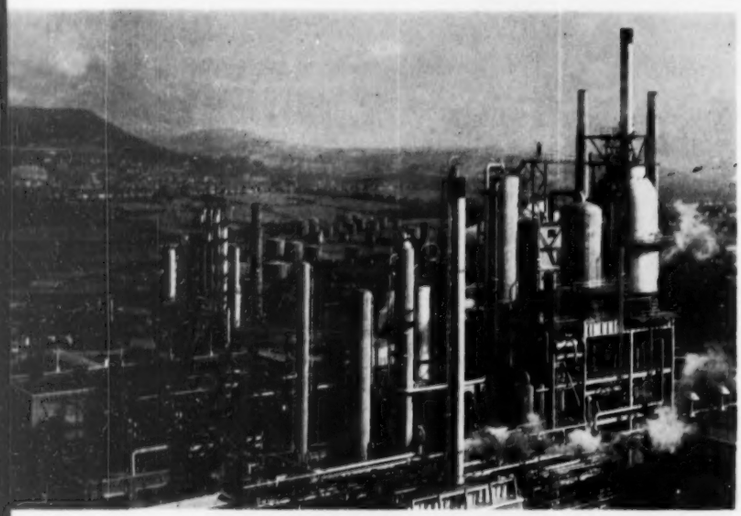
OUT of the furnace and into the press goes the partially finished end . . . up comes the powerful press ring to form the required flange . . . and another Dished and Flanged End is ready.

Furnace and press capacity is available at Harvey's Greenwich works for the pressing of both light and heavy Dished and Flanged Ends. Diameters range from 6" to 9' 0", edges can be prepared for either welding or riveting. For details and tables showing dimensions available, send for List WP 790

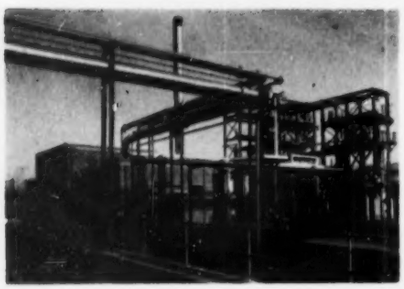
Harvey

G. A. Harvey & Co. (London) Ltd. Woolwich Road, London, S.E.7

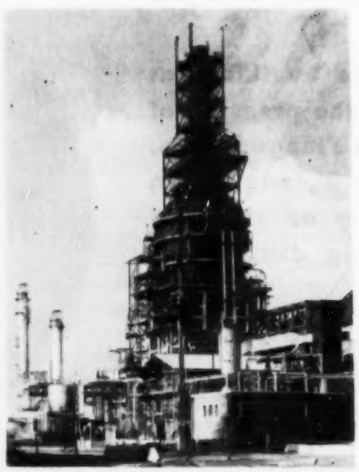
Desulfurization plant erected to recover sulfur in a Claus kiln from sour distillates, including product of the hydrogenation of tractor fuels.



General view of Anglo-Iranian Oil Company's Llandarcy refinery which has been completely modernized since the war.



Autofiner unit at the AIOC Llandarcy refinery.



Cat cracker at Shell's Stanlow refinery built as a part of the company's £30 million post-war construction program.

United Kingdom

(Continued from page 115)

20,000 b/d capacity, and the other an atmospheric unit of 60,000 b/d capacity—both of Badger design and working on Middle East crude.

A small plant built up of old units has been installed for the treatment of bottom settlings from crude storage tanks.

The products from this distillation are: straight run gasoline, white spirit, naphtha, kerosine, gas oil, diesel fuel and residue for fuel or vacuum distillation.

There are three vacuum distillation units including the vacuum side of the 20,000 b/d combination unit, a Foster-Wheeler unit of 2,600-2,700 b/d capacity, and a new vacuum unit of 16,000-17,000 b/d capacity commissioned in 1952. The first two of these units are used for the production of lubricating oil fractions for further treatment and straight run bitumen residue.

The new vacuum unit is designed to produce sharp lubricating oil cuts and has internal reflux and cooling embodied in the tower. Pending the completion and commissioning of the new lubricating oil section, this unit is at present producing cat cracker feed stock, lubricating oil fractions and a fuel residue which will later be used for the production of bright stock after having been propane de-asphalted.

The fluid catalytic cracking plant came on stream in January 1953 and is at present operating satisfactorily at a capacity of 12,500 b/d. The feed stock for this plant consists of waxy cuts from the vacuum distillation units, no gas oil as such being used. The waxy heavy gas oil is recycled in the plant, but the light gas oil, being more difficult to crack, is not recycled and is used for boiler fuel blending and not for diesel oil as the diesel index is low.

Two gasoline cuts are made from this plant as well as a naphtha cut which latter goes for T.V.O.

Straight run gasolines are hypochlorite sweetened and cat cracked spirits are sweetened the same way, followed by soda treatment.

Kerosine is first treated with liquid sulfur dioxide, given a small acid wash, neutralized with caustic soda and finally given a bauxite filtration.

Power kerosine is de-sulfurized in the new "Autofining" unit of 3,500 b/d capacity, a catalytic desulfurizing process patented by the Anglo-Iranian Oil Co. which is giving design efficiency on this product.

Gas oil requires no treatment and is sold as distilled.

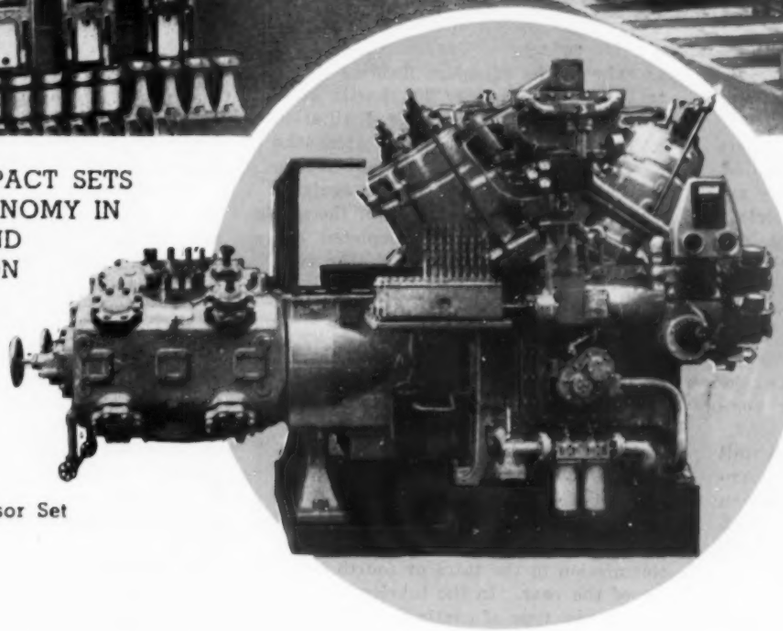
The lubricating oil fractions being at present made in the smaller vacuum units are solvent treated by the Edeleanu process, SO_2-benzol, acid and soda treated and clay finished.

The older type of plant is being used

(Please turn to page 142)

GMX's for de-waxing plant at Fawley

THESE COMPACT SETS ENSURE ECONOMY IN HOUSING AND INSTALLATION COSTS



GMX4 Compressor Set

GMX Compressor Sets building at Belfast for propane de-waxing plant of Esso Petroleum Co's Refinery at Fawley, Southampton.

This plant comprises three GMX8 Chilling Compressor Sets one GMX4 Holding Compressor Set and one GMX4 Blow-Gas Compressor Set.

Also supplied. Two Electrically-driven EM2 type "make-up" Hydrogen Compressors.

HARLAND & WOLFF
COOPER BESSEMER

H & W-COOPER-BESSEMER GMV GAS ENGINE UNITS ARE INSTALLED IN THE REFINERIES AT TRINIDAD, GRANGEMOUTH, LLANDARCY AND ISLE OF GRAIN, AND EM2 TYPE HORIZONTAL, ELECTRICALLY-DRIVEN COMPRESSORS ARE TO BE INSTALLED AT KURNELL, STANLOW AND HAIFA, AND STEAM-ENGINE-DRIVEN COMPRESSORS AT ADEN

H&W-COOPER-BESSEMER Compressors

HARLAND & WOLFF
LIMITED

Engineering Works Queen's Island, Belfast
London Office 9 Whitehall, S W 1

for this, i.e., Sharples centrifuges are used for acid tar separation, the waxy fractions are chilled in vertical coolers, and then filtered in conventional filter presses. The separated wax is sweated to the desired melting point in vertical sweating gloves.

A large new lubricating oil plant has been erected to process Middle East crude and is in course of commissioning. This consists of: (1) a propane deasphalting unit for the treatment of the residue from the large vacuum unit prior to finishing for bright stock, (2) a furfural solvent treating unit built to the latest design for the solvent extraction of the vacuum distillation side streams in the preparation of H.V.I. lubricants, and (3) an M.E.K.-benzol de-waxing unit for the separation of wax from the furfural treated raffinates.

The separated oily wax is repulped in another M.E.K. unit, giving oil-free crystalline wax without any final sweating process, which is then slabbed for sale.

The cooling units for the M.E.K. plant are horizontal coolers of A. F. Craig's design and manufacture.

The final treatment for the lubricants is high temperature clay treatment.

In this refinery there are also lubricating oil barrelling facilities and a Calor gas filling plant.

Four 150,000 lbs/hour Spearing boilers working at 650 psi are being installed, and two more of the same capacity are scheduled to be added later. A certain amount of electrical power is obtained from the grid, but in connection with the new boiler plant, the following turbo-alternators are being installed: two 5,000 K.W. sets and one 3,000 K.W. set. These are being supplied by British Thomson-Houston. The expansion program at the Grangemouth refinery is nearing completion, giving it a 50,000 b/d capacity.

A 17,000 b/d vacuum distillation unit was completed and brought into commission late in 1952 for the preparation of feed stock for the cat cracker, which was successfully put on stream in January 1953 at a throughput of 10,000-12,000 b/d.

A catalytic polymerization unit is in course of erection and is due for commissioning in 1954, as well as a Girbotol unit for desulfurization of the feed.

The capacity of the pipe line from Finnart to Grangemouth is being increased to more than three millions tons per year by the installation of a new pump at Finnart and a new booster pump at Balfron, the intermediate station.

Despite flooding of the Kent refinery on January 30 which interrupted the commissioning of the 80,000 b/d crude oil distillation unit which had just come on stream when the flooding took place, the unit was successfully commissioned in mid-February and is now being operated at about half capacity, the first products leaving by sea at the beginning of March. In addition to this unit, the stabilizing unit is on stream and also the copper chloride sweetening unit for the gasoline.

Construction of the catalytic cracking unit of 10,000-12,000 b/d is well advanced and it is due to be commissioned later this year.

The two vacuum distillation units of 26,000 b/d capacity and a lubricating oil plant (similar to that now being put into commission at the Llandarcy refinery) with a 2,500 b/d output of lube oils are also in an advanced stage of construction. The erection of a Platforming unit is scheduled for the near future.

The effluent water separation plant is in full operation, some of the intake water penstocks for the cooling water having been supplied by Wm. E. Farrer Ltd. who are also supplying large penstocks for the Aden refinery.

The Pumpherston refinery has continued to work on oil produced from shale and natural crude produced in the United Kingdom. During the past year the plant processed 106,500 tons of shale oil and 52,500 tons of United Kingdom crude.

Construction is well advanced on the Coryton refinery of Vacuum Oil Co. Ltd. in spite of the extensive flooding which took place on January 30, shortly after the atmospheric side of the distillation unit had come on stream. After the effects of the flooding had been overcome, the unit was brought on stream again in February. The vacuum side of the distillation plant is not yet completed, but is expected to go on stream in the near future.

The thermal reformer, with a capacity of 2,500 b/d, was put into commission in April 1953, so at the present time the refinery is turning out gasoline, kerosine, gas and fuel oils. Construction on the catalytic cracking plant is well advanced and it is expected to come on stream during the autumn months.

The lubricating oil treatment and deasphalting plants are in an advanced stage of construction and should be in commission in the third or fourth quarter of the year. In the lubricating section, a new type of continuous clay percolating plant is being installed, called "Thermofor Continuous Percolation."

The development of this process was described by Evans, Magin, Savoca and Shea of the Socony-Vacuum Research and Development Laboratories during the mid-year meeting of the American Petroleum Institute's Division of Refining on May 13, 1953.

It is designed to operate on 10-60 mesh size conventional clays as well as bauxite and fuller's earth, and consists of a percolation section, a naphtha-wash section and a regeneration section.

The oil to be decolorized is preheated and introduced into the bottom of the percolation tower through a multi-nozzle distributor. The clay feed, which is adjusted to give the required product color, is fed in at the top and distributed over the cross-section of the tower by a number of feed pipes.

Filtered oil passes out at the top of the tower and is passed through a blotter press to take out any traces of entrained clay. The exhausted clay passes out at the bottom of the tower through a controlled draw-off system, then passes to the wash tower where it is washed counter-currently with naphtha.

The naphtha-oil passes to a stripping tower, the naphtha returning to stock for further use, and the washed oil returning to feed stock. The washed clay containing some naphtha then passes to a dryer where the dry clay, free from naphtha, is continually drawn off and passes to a Thermofor clay-burning kiln and then into stock for re-use.

It is claimed for this process that the consumption of clay is less than in other percolation processes and that the percentage of finished lube oil from equivalent stocks is greater.

At the beginning of the current year, a new atmospheric distillation unit came on stream at the Manchester Oil Refinery Ltd. plant. Prior to this the distillation plant consisted of a vacuum distillation unit working on topped crude. The addition of this new unit enables the refinery to work on ordinary stabilized crude and to increase its throughput by approximately 30,000 tons per year.

The new unit is of the latest design of the Badger Process Division of the Stone & Webster Corp., and was constructed by that company's associate, E. B. Badger (Gt. B.) Ltd. The fractionating column, which is about 120 feet high and weighs 37 tons, was fabricated by Edwin Danks & Co. Ltd. (associates of Babcock & Wilcox Ltd.). It was designed for very close fractionation: gasoline, white spirit (or kerosine) and gas oil are taken off as side streams and the residue is circulated through a vertical, up-draft heater to provide re-boil heat to control the fractionation in the column.

In addition to this unit, expansions have been made in other refinery plants. In the solvent extraction plant a new extraction compressor, a new evaporator heater, drying columns, etc., have been installed to increase capacity, and additions made to the chemical treatment and blending plants.

Lobitos Oilfields I td. has increased its cracking capacity during the year from 1,000 b/d to 1,400 b/d and has also installed a "Unisol" plant of 600 b/d capacity for treating cracked gasoline.

The crude oil capacity of the Berry Wiggins & Co. Ltd. refinery at Kingsnorth-on-the-Medway, Hoo, Kent is 2,000 b/d and has run to full capacity during the year. A Foster-Wheeler two-stage distillation unit of 2,100 b/d charging capacity is now in course of erection and is scheduled for completion by November 1953.

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Recent Trends in Petroleum Refining Patents

(Continued from page 122)

carbon atoms from the saturate if the latter is an isoparaffin.

Hydrogenation and Dehydrogenation: Since dehydrogenation and hydrocracking are features of most of the new reforming processes, there is an overlap with patents described earlier. Almost all patents presently issuing on these subjects use hydrogen removal, addition, or transfer in either the upgrading of heavy fuels in naphtha reforming or dehydrodesulfurization.

Hydrogenolysis is the subject of Phillips Petroleum Company patent 2,619,450 (H. W. Flemming) in which heavy hydrocarbon material is catalytically hydrogenated at 800° to 900°F. with not more than 400 cu. ft./bbl. of hydrogen to produce gas, gasoline and gas oil. In another patent to the same company, (2,627,495), W. C. Lanning subjects a heavy residuum containing both paraffins and aromatics to extraction to selectively dissolve aromatics. The raffinate is subjected to high pressure hydrogenolysis. The aromatic extract is freed from solvent and hydrogenated at different operating conditions. Gasoline of good quality is recovered from the latter treatment, while gasoline recovered from treatment of the raffinate is recycled as solvent to the extracting operation.

Haensel (2,622,111 to Universal Oil Products Company) describes a method for saturating hydrocarbons such as benzene by contact with hydrogen over a catalyst prepared from an inorganic oxide carrier, such as silica, which has been treated with a solution of a normally solid aromatic hydrocarbon, such as diphenyl, and then composited with a noble metal.

Desulfurization: Patents on desulfurization can be roughly classified as falling in two groups: viz., sulfur removal by hydrogenation, and sulfur removal by extraction. A number of significant new ideas relative to the second group have been discussed in the patent literature of recent months.

Two Standard Oil Company of Indiana patents deal with extracting agents. H. Shalit (2,623,004) removes aromatic sulfur compounds from naphthas and gas oils by extraction with dimethylformamide. R. C. Arnold and J. F. Deters (2,634,230) treat a high sulfur, olefinic naphtha with 2,4-dimethylsulfolane and one to five percent water based on the solvent. The extract phase contains most of the sulfur and the raffinate phase most of the olefins. After removal of solvent and water, the extract phase is hydrodesulfurized and the product blended with the olefinic raffinate phase.

Strong (60-75 percent) rather than dilute caustic is used by L. D. Kleiss (2,623,008 to Phillips Petroleum Company) to remove mercaptans from naphthas at 100° to 300°F. Mercaptides separate from the hydrocarbons as precipitates. Caustic losses due to emulsification are reduced. The disulfides obtained in caustic extraction processes can be converted to sulfonyl chlorides by treatment with chlorine and oxygen at 5° to 15°C. in the presence of nitrogen dioxide as catalyst (W. A. Proell, W. B. Chilcote, and B. H. Shoemaker, 2,598,014 to Standard Oil Company of Ind.).

Another method of converting mercaptans in hydrocarbon liquids to polysulfides is described by G. W. Ayers and E. E. Harton (2,626,890 to Pure Oil Company). The liquid is agitated with an alkaline treating solution containing as a catalyst a sulfonated compound capable of promoting the oxidation and aerating the mixture. Naphthoquinone or hydroquinone are suitable catalysts.

Hydrocarbon Synthesis and Recovery: The very large volume of work which a few years ago was carried out in many laboratories on the Fischer-Tropsch synthesis is now reflected in the large number of patents issuing. Most of these deal with improvements in equipment and method of operation and cannot be discussed without detailed description. More chemical in nature is U.S.P. 2,628,969 (W. Bottig to Ruhrchemie, A.G.) which discloses the production of large volumes of oxygenated products from carbon monoxide and hydrogen over an iron catalyst which has been incompletely washed after precipitation, so that it contains 5 to 10 percent of alkali metal salt. A iron nitride catalyst is discussed by R. B. Anderson and J. F. Shultz of the Bureau of Mines (2,629,728). This catalyst, prepared by nitriding fused iron oxide in ammonia at 200° to 550°C., has greatly increased activity and permits high conversions at low temperatures.

The use and recovery of shale oil has recently become a more frequent subject of patents. U.S.P. 2,630,306 (L. P. Evans to Socony-Vacuum Oil Company) and 2,630,307 (J. W. Martin to Carbonic Products, Inc.) discuss methods of subterranean retorting of shales.

Fuel Oils, Heavy Oils and Waxes: This group of patents comprises the largest number of patents in any group, 26 percent. This figure reflects not only active research, but also the fact that most of these patents claim a new compound suitable as an additive for inhibiting corrosion, oxidation, etc., rather than a new process. It is almost impossible to establish trends in this field and rather than enumerate the many compounds proposed, a few examples may suffice.

A. R. Jones and J. O. Smith (2,627,511 to Standard Oil Development Company) describe a new antioxidant obtained by reacting equimolecular amounts of an aryl sulfonyl halide and an alkali metal mercaptide containing five to 30 carbon atoms at a temperature of 20° to 100°C.

The incorporation of bentonitic clays into greases is the subject of several patents. S. T. Abrams and F. H. Stross (2,626,899 to Shell Development Company) disclose a composition of lubricating oil and montmorillonite. The colloid bears at least 30 percent by weight of hydrophobic cationic surface-active radicals of which at least 50 percent shall be in the form of salts with a phosphoric acid. Thickening of a synthetic lubricating oil to a grease by mixing it with a complex formed by reacting bentonite with an aliphatic amine salt is claimed by W. J. Sparks, A. J. Morway and D. W. Young (2,626,241).

Petrochemicals: The increasing emphasis placed by petroleum companies on the production of chemicals is expressed in the constantly increasing volume of patents in the petrochemical field. Only a few of the many interesting developments can be discussed here.

Hydration of olefins, long a field of study, has again been investigated using HF and BF_3 as catalysts. Atlantic Refining Company's 2,617,834 (J. E. Woodbridge) contacts olefins at 25° to —50°C. with an aqueous solution of BF_3 and liquefied sulfur dioxide. A weight ratio of sulfur dioxide to olefin from 0.05 to 5:1 can be employed. C. B. Linn (2,616,933 to Universal Oil Products Company) uses HF as a hydration catalyst.

Oxidation of olefins is an active subject. Two du Pont patents (2,615,899-900, G. W. Sears, Jr.) disclose the oxidation of ethylene over a silver catalyst diluted by 25 to 75 volume percent of the composition of granular graphite. The catalyst may contain metal halides. A continuous oxidation process using a cuprous oxide catalyst is claimed by K. D. Detting and T. Skei (2,614,125 to Shell Development Company). The olefin and oxygen are passed over the catalyst at 300° to 500°C. and the olefin flow is periodically discontinued to clean the catalyst of contaminants.

The oxidation of benzene homologues to phenols is described by a group of English inventors (B. V. Aller, R. H. Hall and K. H. W. Turck) in Hercules Powder Company's patents 2,628,983-5.

Carbon disulfide may be prepared from a mixture of sulfur vapor and hydrocarbon gas by contact with a magnesia-silica gel catalyst, according to H. O. Folkins and E. Miller (2,616,793 to Food Machinery & Chemical Corporation).

Acetylene and hydrogen cyanide are the raw materials for the production of acrylonitrile in Celanese Corporation of America's patent 2,621,204 (A. F. MacLean and D. E. Pickart). An aqueous solution of copper chloride and NH_4Cl forms the catalyst. Reaction gases are passed through benzene, toluene, diphenyl ether and xylenes for absorption of acrylonitrile.

An ignition promoting additive to a diesel fuel is disclosed by L. T. Eby (2,614,914 to Standard Oil Development Company). It consists of a dialkyl sulfide having tertiary alkyl radicals of 8 to 25 carbon atoms and having 4 to 8 sulfur atoms linked with the tertiary alkyl radicals. Di-tertiary octyl tetrasulfide is a suitable additive.

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U.S. Refining Capacity

(Continued from page 127)

pacity, built by the Lummus Co., was to be completed the first of this month. A catalytic reforming unit, capacity 8,000 b/d, built by Houdry Process Corp., is to be on stream in January 1954.

This is to be followed in July 1954 by a sulfuric acid alkylation unit, capacity 1,500 b/d. The Ralph M. Parsons Co. is contractor.

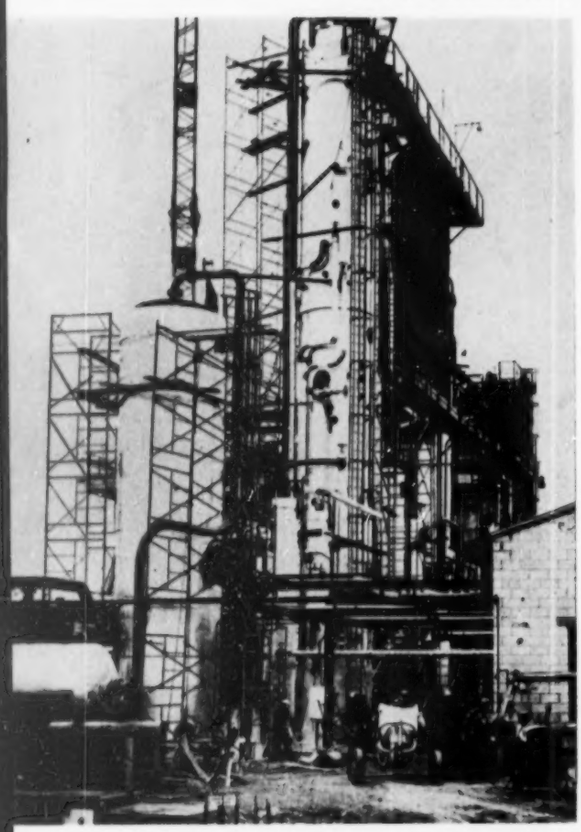
The entirely new refining plant of International Refineries, Inc., near Duluth, Minn., began operation May 2. The plant is supplied with Western Canadian crude by the Interprovincial line from Edmonton, Alberta. The 10,000-barrel plant is designed for integrated topping, cat cracking and polymerization steps. The Lummus Co. was contractor.

The Pure Oil Company's Toledo, Ohio refinery major construction projects include a fluid catalytic cracking unit and a catalytic polymerization unit. Both Toledo projects are scheduled for completion later this year.

Also at Toledo, Sun Oil Co. is building a 15,000 barrel catalytic reformer.

Standard Oil Co. of Ohio recently broke ground for a new research laboratory at Cleveland as the latest element in its $40 million postwar building program. At the moment, Sohio also is increasing its catalytic cracking capacity at Cleveland and Lima and building a 12,000 b/d catalytic reformer at the latter plant. Crude stills at Cleveland are being modernized with an increase of 7,000 b/d in capacity. At Toledo, alkylation capacity is being expanded.

Distillation towers of the $7 million refinery built by The Lummus Co. for International Refineries, Inc., at Wrenshall, Minn.



Shell Oil Company's modernization program, begun in 1951 for its five existing refineries, is continuing and is expected to be completed late in 1954. This program alone will ultimately add 100,000 barrels a day to Shell refining capacity.

At Wood River, Ill., a new crude oil distillation unit, gas recovery facilities and additions to the catalytic cracking plants are in the late stages of construction with completion expected shortly. A vacuum feed preparation unit and a 16,000 b/d Platformer are under construction. Replacements and additions are progressing for other basic units and auxiliaries. When the new facilities are placed in full operation, late in 1954, the refinery will have a rated crude intake capacity of 170,000 barrels a day.

Socony-Vacuum is preparing to built a TCC cat cracker and a cat poly unit, and to expand its alkylation unit at East St. Louis, Ill. All three are planned for completion in June, 1954. At Trenton, Mich., the company will complete a cat poly unit late this year.

At Lemont, Ill., Globe Oil & Refining Co. is building an alkylate plant and a cat cracker. The alkylation unit will be operating in October or November and the cracker in March or April 1954.

In the Oklahoma-Kansas sector of District 2, a number of projects are being planned or built. Sunray Oil Corp. in June asked for bids on a 9,000-barrel delayed coking unit for erection at Duncan, Okla. Plan is to have the unit complete in 1954.

Socony-Vacuum is building a new type TCR catalytic reformer at its Augusta, Kans., refinery which is expected to be on stream next January.

A number of projects are being completed at about this time. Standard of Indiana is finishing a catalytic cracker, alkylation and vapor recovery units at Neodesha, Kan. El Dorado Refining Co. has completed a $3.5 million program including a cat cracker and asphalt production equipment. Other units of the plant were enlarged and modernized. Also in Kansas the Co-op plants at McPherson and Phillipsburg have completed new jobs. At McPherson a 10,000-barrel coker was built and at Phillipsburg crude capacity was increased and a cat cracker built.

In Oklahoma also, the Co-op plant at Cushing is being enlarged and modernized. Work includes a cat cracker, vis breaker, cat poly unit and crude still.

Mid-Continent Petroleum Corp. at Tulsa is increasing its alkylation and cat cracking facilities and recently has let a contract to M. W. Kellogg Co. for the erection of a 7,500 b/d Atlantic Catformer to cost $2.5 million. Completion is planned for mid-1954.

Ben Franklin Refining Co. at Ardmore, Okla., is completing a fluid cat and building an asphalt unit for the production of penetration grade asphalts and cutback oil.

Continental Blacks, Inc., a newly formed organization, will build a $2,750,000 plant at Ponca City, Okla., designed to manufacture 40 million pounds annually of high abrasion black from oil. Continental, Robert I. Wishnick of New York City, and The Shamrock Oil and Gas Corp., Amarillo, will be joint owners of the new enterprise.

PAD District 3, with more than a third of the nation's refining capacity at the opening of the current year, has an expansion program of about six percent for the 24 months ending December 31, 1954. As previously mentioned, the rate of expansion is less than on the Atlantic seaboard. There are a number of important new projects now in the completion stage and others which will not be ready to operate for a year or more.

Continental Oil Co. is nearing completion of its $27 million expansion program at Lake Charles, La. Capacity of the plant will rise from 12,000 to 40,000 b/d. The new units will go on stream progressively late this month and during August.

Also at Lake Charles, Cities Service Oil Co. has initiated a $22 million plan to increase plant capacity and octane rating of its motor fuels. A catalytic reformer is to be built and additions and changes are to be made in the alkylation unit and cat crackers. Cracker feed stock will be increased by installation of a new vacuum unit. A high pressure boiler will be added to the utilities.

At the Norco, La., refinery of Shell Oil Co., design of new facilities is completed, detailed engineering and ordering of material are well advanced, and field work is in progress. Norco expansion includes a crude distillation unit, a catalytic cracking unit, with feed preparation and product gas recovery facilities, and alkylation and polymerization units. This program, expected to be completed late in 1954, will increase crude intake capacity 50 percent to 75,000 barrels a day.

Pan-Am Southern's 8,000 b/d refinery at Destrehan, La., has recently completed an expansion program that will increase its crude running capacity to 30,000 b/d. The major processing units built during the expansion are a Type IV Fluid Catalytic cracking unit, a sulfuric acid alkylation unit, a fluid hydroformer, and a combination crude running-delayed coking unit. In addition, the existing crude unit was modified and expanded. Auxil-

(Please turn to page 148)

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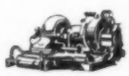

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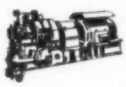

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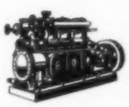

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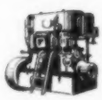

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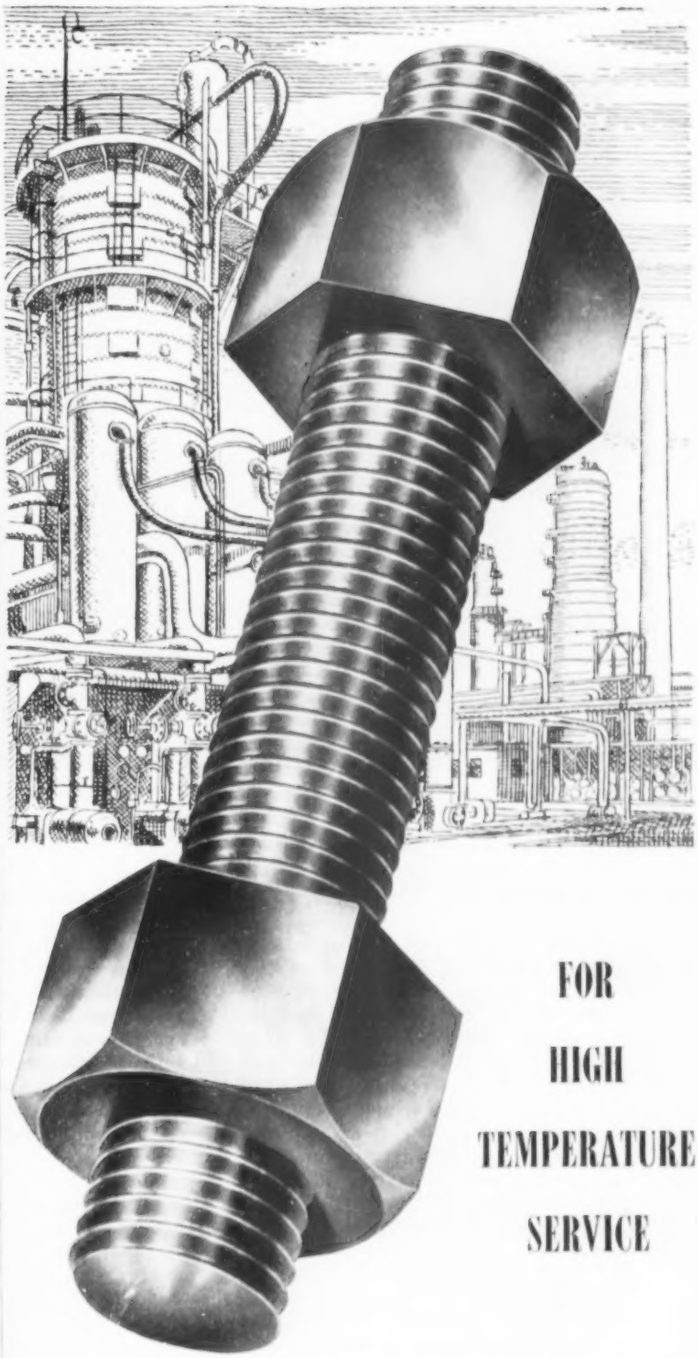

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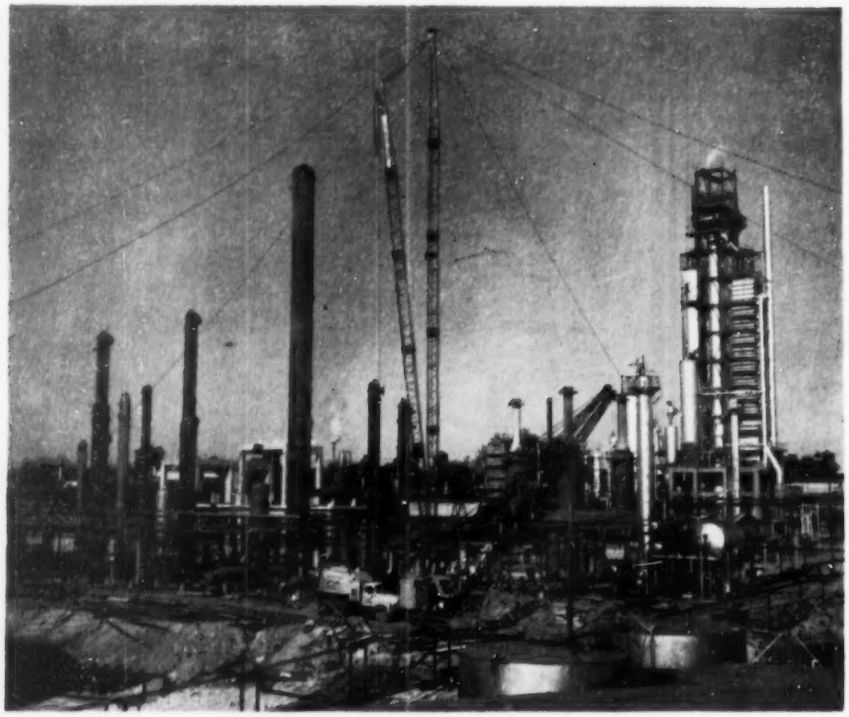

Lion Oil Company is building a new cat cracker, alkylation unit and vapor recovery unit at El Dorado, Ark.

U.S. Refining Capacity

(Continued from page 146)

iary facilities required for the enlarged refinery included a new water treating system, a cooling tower, high pressure steam boilers, and additional tankage and treating facilities.

The fluid Cat at Destrehan is the first Type IV to go on stream in the United States. The unit was originally designed to process charge stock at high conversion with a naphtha component segregated for a blocked out retreat operation. The unit is currently being operated on a once through basis producing motor gasoline base stock and a C_3-C_4 cut which is used as charge for the alkylation unit. Maximum feed rate has not been finally established, but throughputs averaging 15,000 barrels a day have been realized without fully utilizing coke burning capacity.

The sulfuric acid alkylation unit is designed to process all of the C_3-C_4 stream produced from the cracker and coker. An isobutane deficiency is made up from purchased stocks.

The fluid hydroforming unit at Destrehan is a completely new development which extends the fluidized technique to the hydroforming process. This process, incorporating development features of the Standard Oil Company (Ind.), Standard Oil Development Co., and The M. W. Kellogg Co., results in a product of high octane number with higher liquid yields than are obtained from the fixed bed hydroforming process. At the same time, the feed stock can be varied over a wider range than is possible in the fired bed process since the small quantity of coke produced is continuously removed by regeneration. The additional flexibility permitted by using the fluid process allows also for a greater range of operating conditions. The charge to the fluid hydroformer is virgin naphtha which has previously been prefractionated at the crude unit. Operating pressure for the unit usually averages about 250 lbs.

The crude running and delayed coking unit is designed to coke all of the reduced crude produced from the vacuum tower of the expanded crude unit together with additional reduced crude produced from processing approximately 10,000 b/d of heavy crude oil in the crude section of the unit. Products from this unit include fuel gas and gasoline, kerosine, cracking charge stock and petroleum coke. Design coke production is approximately 400 tons per day.

Also in the New Orleans district, Lion Oil Co. is spending $31 million on the erection of a new ammonia and fertilizer plant similar to its earlier installation at El Dorado, Ark. The plant, at Luling, La., will produce 300 tons per day of anhydrous ammonia of which 50 tons will be sold and the remainder used to produce 550 tons of prilled ammonium nitrate fertilizer. Natural gas is the raw material. Completion is planned for mid-1954.

At the company's El Dorado headquarters, Lion is spending $5 million to expand its refinery. Completion is planned for this fall on a new 10,000 b/d cat cracker and a 1,000 b/d increase in alkylation capacity. The Lummus Co. is contractor. Included in the project is equipment for the production of LPGas. Light vapors now are being burned.

Esso Standard Oil Co. is building a 60,000-barrel fuel products plant at Baton Rouge, La., which will be on stream in the second quarter of 1954. M. W. Kellogg Co. and Refinery Engineering Co. are contractors. A 5,540-barrel pressed oil distribution unit will be built for Standard at this plant by Ralph M. Parsons Co.

In the Port Arthur district in Texas, Pure Oil, Gulf and Texaco are engaged in active building. Gulf has two major units in the design stage, one a 29,000 b/d Platformer, the largest catalytic reformer thus far projected or built. Gulf will increase its participation in the petrochemical field by building an ethylene plant to produce 220 million pounds per year. Bechtel is building a 3-reactor acid film catalytic polymerization plant for Gulf at Port Arthur to be completed this fall. Next year a new 600,000 lb/hr steam plant will be built.

At Pure Oil Company's Smiths Bluff refinery, Nederland, Texas, completion is scheduled this fall on a fluid catalytic cracking unit, a catalytic polymerization unit and enlargement of alkylation facilities. The M. W. Kellogg Co. is constructing the major portion of the new facilities.

The Texas Co. is building a 20,000-barrel Platformer at Port Arthur which will be complete in about a year. Cracked naphtha stabilizing facilities are being enlarged.

Elsewhere in the state, Texaco is expanding and modernizing both its Amarillo and El Paso refineries. Both jobs will be complete at the end of 1954. At Amarillo, crude capacity will rise 7,500 b/d. Other units being built include a cat cracker, delayed coker, alkylation unit, cat poly, treater, LPGas facilities and auxiliaries. The El Paso project embraces similar units. Crude capacity will rise 5,400 b/d.

At Texas City, Pan American Refining Corp. is revamping one of its combination cracking units into a feed preparation unit for the new catalytic cracking unit. A new 30,000 b/d combination fluid catalytic cracking unit and polymerization unit is being constructed. A 2,500 b/d addition to the present alkylation unit also will be completed in the fall of this year.

Work is progressing on a new administration building, a new research laboratory building, and an addition to the engineering building. Completion of these buildings is expected early in 1954.

The McMurrey Refining Co., Tyler, Texas, recently announced the start of a refinery modernization and expansion

(Please turn to page 150)

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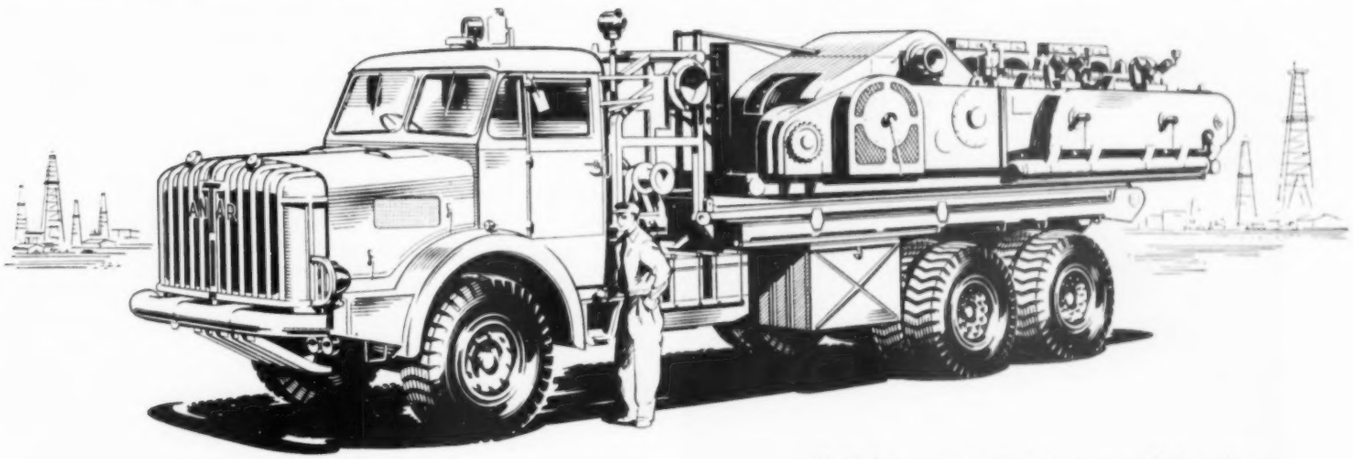

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Reactor of new phosphoric acid poly unit completed in May for California Oil Company at Perth Amboy, N. J.

U.S. Refining Capacity

(Continued from page 148)

program to double capacity. Contracts for crude distillation and feed stock decarbonizing units have been awarded to Blaw-Knox Co.

Prospective completion of the Trans Mountain pipe line which will deliver Canadian crude to the Pacific Northwest is creating an entirely new refining center in the Puget Sound area in the United States as well as stimulating a very large expansion across the border in British Columbia.

Shell Oil Co. has recently announced the prospective erection of a 50,000 b/d refinery in the Pacific Northwest. A site at Anacortes, Wash., is a location where the new refinery may be built, but the company is also considering two or three other sites on Puget Sound. Decision to build will depend on settlement of title problems and assurance that suitable sources of fresh water and electrical power will become available.

Preliminary plans call for a refinery that would process about 50,000 b/d. Company spokesmen said design details have not been completed, but the refinery would include crude distillation, feed preparation, catalytic cracking and reforming units. The refinery would help process supplies from the line now being built by Trans Mountain Oil Pipe Line Co. to transport Alberta crude oils to the Pacific Coast.

Plans to construct a new $10 million refinery near Vancouver, B.C. were announced June 30 by T. S. Petersen, president of Standard Oil Co. of California. The new 11,000 b/d plant, designed to utilize Canadian crude, will be constructed and operated by Standard Oil Co. of British Columbia, a wholly-owned subsidiary.

It will be built on a site adjacent to the company's presently-operated refinery at Burnaby, near the western terminal of Trans Mountain Pipe Line, now being completed from Alberta oil fields.

Major elements of the new refinery will include catalytic cracking and polymerization facilities, as well as a two-stage crude distillation unit.

At Shellburn, B. C., Shell of Canada will more than double the crude intake capacity to 15,000 b/d. New facilities will include a catalytic cracking unit, feed preparation and product recovery system, polymerization and increased tankage and product handling facilities. Completion of the Shellburn program is scheduled for early 1954 although the first stage is to be ready for operation late in 1953 to coincide with commencement of operation of the Trans Mountain line.

At Wilmington, Calif., a new 50,000-barrel-a-day crude distillation unit is being installed by Shell Oil to help process new supplies of California crudes and additional quantities of natural gasoline now being recovered from the Ventura field. This unit is expected to go on stream late this year.

At Martinez, Calif., a new Platforming plant is planned with capacity of 4,500 b/d. This unit, scheduled for completion about the middle of 1954, will improve the quality of West Coast gasoline.

Construction already is in progress on General Petroleum Corporation's new 35,000 b/d refinery at Ferndale, Wash. This plant will take crude oil from the Trans Mountain Pipe Line Company's line from Alberta. Processing units include crude distillation with vacuum tower, a vis-breaker, a catalytic reformer and catalytic cracking unit. The cost of the refinery will be in excess of $35 million. Bechtel Corp. is the contractor. Completion is scheduled for the fall of 1954.

A Thermofor catalytic reformer is to be added to the company's 100,000 b/d Torrance, Calif. refinery. This unit will charge 19,000 b/d of gasoline. It is one of three being built in the United States by Socony-Vacuum Oil Co. Inc., and its affiliates at a total cost (for all three) of $27 million.

Standard Oil Company of California's multi-million dollar program of refinery expansion is proceeding on schedule with a new $10 million benzene plant recently placed on stream at El Segundo. Contracts for other major additions have been awarded with construction on all new units scheduled to be well under way or completed by the close of the year.

At the El Segundo refinery contracts for construction of a 40,000 b/d catalytic cracker, an addition to the alkylation plant, and alterations to the naphtha rerun stills have been awarded to Fluor. Kellogg will build a 52,000 b/d residuum stripper and off-site facilities will be erected by Macco Corp. Preliminary work began in May. On stream date for the project is September 1954.

Work on a para-xylene plant began in March by Fluor and Macco. The entire project should be completed by January of next year. Contract for a cumene plant has been awarded to Rosendahl Corp. July 1 was set as the starting date and the unit should be finished by the end of the year.

At the Richmond refinery, Standard of California has awarded contract for a phenol plant to Stone & Webster. Construction is under way and it is expected the plant will be ready for operation by March 1954. Two of the three major sections of a phthalic anhydride plant expansion are now completed. The third section is expected to be ready for operation by the end of July.

A comprehensive expansion and modernization program to cost $40 million is in progress at the Watson, Calif., refinery of Richfield Oil Corp. Crude capacity will be increased 20,000 b/d to 125,000 b/d. Catalytic cracking, ethylene production, alkylation expansion and utilities are embraced in the plan which will be completed in 1954. Braun is building the fluid cat cracker and Fluor the alkylation facilities, fractionating and cooling towers and other auxiliaries.

(Please turn to page 177)

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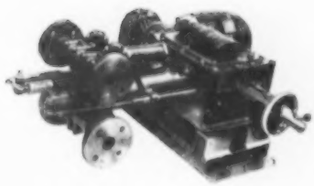
Solenoid-operated plunger pump with variable stroke and speed



Duplex high-duty pump with mechanically operated suction valves

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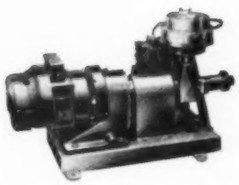
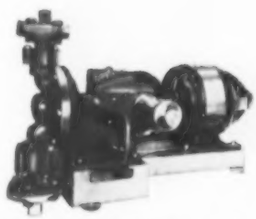


Single-stage gas pump. Suction 75 mm. Hg absolute to delivery press: 5 lb. per sq. inch gauge.

DIAPHRAGM PUMPS in single units are made in a range of standard sizes covering capacities of from 1 to 1,000 gals. per hour at normal pressures. These pumps are made also as multiple units.
HYDRAULICALLY operated diaphragm pumps are supplied for pressures up to 1,500 lb. per square inch.
DIAPHRAGM PUMPS for circulating GASES at moderate differentials are constructed for pressures up to 1,000 lb. per square inch, and in single, double and treble stage units for dealing with rare gases under high vacuum and delivering under pressure to gas analysis equipment.



Standard G/250 diaphragm pump with micro-variable control.

PLUNGER PUMPS as single units with ram diameters of from $\frac{1}{2}$-in. dia. to 4-in. dia. and capacities of from 5 ml. to 500 gallons per hour and pressures up to 20,000 lb. per square inch.
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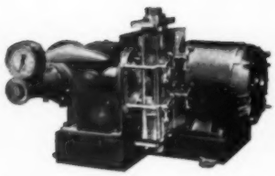
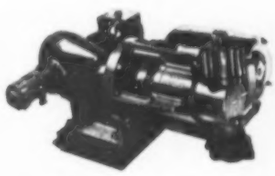
PUMPS are available in a wide range of chemical-resistant materials and include various grades of stainless steel, monel metal, bronze, aluminium, glass-lined cast iron, ceramics, ebonite, Perspex, polythene, etc. Diaphragms are supplied in many resistant materials, including silicone rubbers and polytetrafluoroethylene.



Diaphragm pump micro-capacity control with dial type stroke adjustment indicator.

CAPACITY CONTROL of extreme accuracy is maintained by E.C.D. patented micro-variable control capable of operation manually, mechanically or automatically. Re-setting for capacity within 1 per cent.

MULTIPLE pump sets of up to eight pumps, driven by one motor for a complete process, each pump fitted with independent capacity control and the volume of the mixture can be varied whilst maintaining the blend by the use of a variable-speed motor which can be automatically controlled if required.



Standard G/250 plunger pump. Low-pressure type with micro-control.

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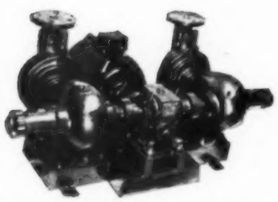
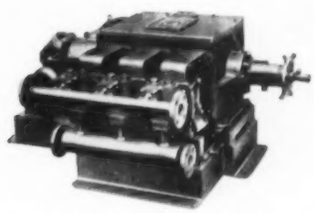
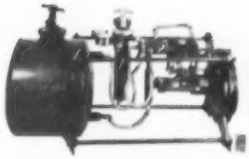


Twin G/250 diaphragm pumps. Can be supplied in multiple units of eight or ten pumps.



Treble plunger pump with micro-variable volume control. High volumetric efficiency straight-line variable capacity



Pneumatic chemical feeder driven by natural gas or compressed air

D. A. Young

J. R. Fraser

D. A. YOUNG has been elected president of Sinclair Crude Oil Co., a newly organized subsidiary of Sinclair Oil Corp. The new company will purchase and sell crude. Mr. Young formerly was Sinclair refinery manager at Houston. His new headquarters will be at Tulsa.

W. ALTON JONES has been elected chairman of the Cities Service Company, and Burl S. Watson president. Mr. Jones will serve as chief executive officer. He will turn over to Mr. Watson certain administrative duties and devote increasing attention to the long-range expansion and development of the Cities Service oil and natural gas interests in both the domestic and foreign fields.

Mr. Watson, formerly executive vice president, has been with Cities Service for 36 years, joining it as a cadet engineer in 1917 after graduation from the University of Alabama. He is an officer and director of numerous Cities Service companies whose interests range from lower Manhattan real estate to oil operations, both domestic and foreign, natural gas, pipe lines, tanker operation, refining and manufacturing, petrochemicals and other phases of the oil and natural gas industries.

Mr. Watson has been intimately associated, during the past quarter century, with the growth and development of the Cities Service oil and natural gas operations, and their integration into a single system operating in all states east of the Rocky Mountains, in Canada and in Mexico.

Mr. Jones became president of Cities Service in 1940, succeeding the late Henry L. Doherty. During his presidency, the company disposed of its electric and natural gas utility properties while at the same time rapidly developing and expanding its oil and natural gas business.

JACK R. FRASER has been appointed chief petroleum engineer for Texas Eastern Production Corp. of Houston, Texas. He joined Texas Eastern in 1951 as district geologist and has most recently served the company as division engineer.

OLEN LANE, Los Angeles, Calif., assistant regional general manager of Continental Oil Company's western region, has been promoted to regional general manager to succeed C. R. Allen, who is retiring because of ill health. Mr. Lane has been with Continental for 33 years, and since 1923 has been active in the company's West Coast operations.

DR. RICHARD L. SAWYER has been promoted to supervisor, fuels development research department, at The Texas Company's Beacon, N. Y. laboratories. He has been with Texaco since 1938 and before his recent promotion was an assistant to the assistant director of research.

W. A. Jones *B. S. Watson*

RALPH H. HANDREN has been named chief accountant of Sun Oil Company's Canadian refinery, now under construction at Sarnia, Ontario. A native of Canada, Mr. Handren joined Sun in 1952 and has served at the company's Toledo, Ohio, refinery.

M. D. LARSON will be superintendent of the industrial relations division at the new refinery of Standard Oil Company (Ind.) in Mandan, N. D. Since 1950 he has been assistant superintendent of the industrial relations division at Standard Oil's Sugar Creek, Mo., refinery near Kansas City, Mo.

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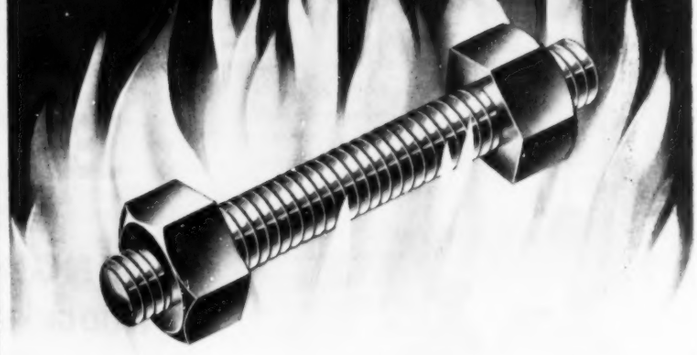

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J. T. Higgins

J. T. HIGGINS has been elected president of Salt Lake Refining Co. and Salt Lake Pipe Line Co. to succeed C. E. Finney, Jr., retired. Mr. Higgins was manager of operations at the Richmond refinery of Standard Oil Company of California.

It was under Mr. Finney's direction that the refining company began construction of its North Salt Lake plant in 1948, and he has since guided its further expansion and development until it is now capable of processing 30,000 barrels of crude oil daily. He also directed construction of two major oil pipe line projects in the area.

Mr. Higgins has worked for Standard since 1929. He served as a specialist and foreman at its El Segundo refinery until 1937. He has worked at Richmond and in San Francisco since that time.

S. K. CLARK, Houston, manager of Continental Oil Company's royalty department, has been given the additional responsibility of manager of the company's foreign department. He will work closely with Hudson's Bay Oil & Gas Company Ltd., and Conorada Petroleum Corp., Conoco affiliates.

H. G. FAIR, formerly superintendent of the Kansas City, Kans. refinery of Phillips Petroleum Company, has been advanced to vice chairman of the company's operating committee. He has transferred to Bartlesville.

V. C. Cavin, formerly assistant superintendent of the Phillips, Tex. refinery, has been promoted to superintendent of the Kansas City refinery, replacing Mr. Fair. K. A. Anderson, formerly mechanical superintendent of the Phillips, Tex. refinery, has been promoted to assistant superintendent at the Phillips refinery, replacing Mr. Cavin.

Mr. Fair joined Phillips in 1939 and has served continuously in the refining department, being appointed assistant to the manager of the department in 1945. In 1947 he was made assistant superintendent of the Kansas City refinery and in 1951 was advanced to superintendent.

Mr. Cavin joined Phillips in 1939, and following several years of service at the company's Okmulgee, Okla. refinery, was advanced to assistant mechanical superintendent at the Phillips, Tex. refinery. In 1949 he was promoted to mechanical superintendent and in 1948 became assistant superintendent of the refinery at Phillips.

Mr. Anderson came to Phillips in 1935 and has served continuously at the Phillips, Tex. refinery, being promoted to chief chemist in 1947. In 1948 he was advanced to mechanical superintendent of the refinery.

J. T. CLARK has been appointed district geologist for Phillips Petroleum Company at Amarillo, Texas. He succeeds A. C. Hornaday, resigned.

F. S. Goerner

FRED S. GOERNER has been appointed exploration manager of the British American Oil Producing Company's southern division at Houston. He has been with the Standard Oil Co. of Texas as chief development geologist.

ROSS W. THOMAS has been elected a director of Phillips Petroleum Co. to succeed C. P. Dimit, retired. Mr. Thomas is vice president in charge of research and development.

DON B. CAMBLIN, Houston, industrial relations manager of the southern and southwestern regions of Continental Oil Co., has been appointed assistant superintendent of the company's Ponca City, Okla. refinery. He is succeeded by Max E. Stansbury, Houston, administrative assistant to the industrial relations manager.

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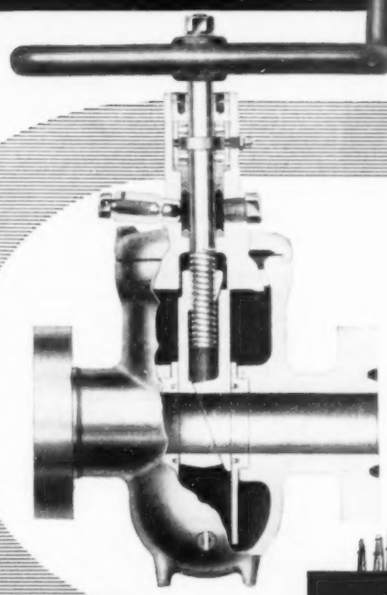

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SM59

C. A. CHIPMAN, oil producer of Bolivar, N. Y., has been elected president of the Pennsylvania Grade Crude Oil Association, succeeding C. E. Streeter, oil producer of Bradford, Pa. Directors of the association, at an annual meeting in Hotel William Penn, also elected A. C. Simmons, Bradford oil producer, second vice president succeeding Mr. Chipman.

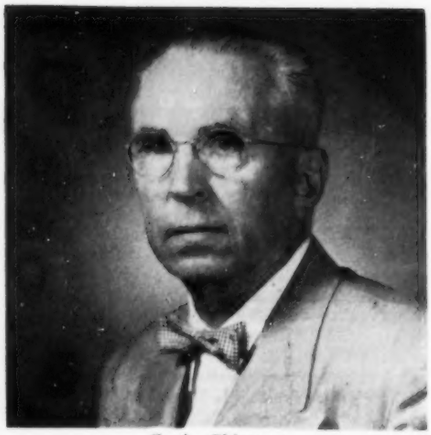
Other officers reelected are: George J. Hanks, first vice president; Fayette B. Dow, vice president and general counsel; Samuel Messer, treasurer; F. W. Alcorn, C. G. Johnson and C. L. Suhr, assistant treasurers; and W. C. Wenzel, executive manager.

J. W. FOLEY, assistant to the chairman of The Texas Company, has been elected a vice president. Mr. Foley joined Texaco in 1932 as a rotary rig helper, and served in various capacities in Louisiana, Bahrain Island, and Texas until 1949, when he became assistant to the vice president of production. The following year he became assistant to the chairman of the board.

GEORGE V. MYERS has been named manager of the financial departments of Stanolind Oil and Gas Company, a newly-created position. Mr. Myers comes to Tulsa from Pittsburgh, where for the past two years he has been controller for the Westinghouse Air Brake Co.

C. T. KLEIN has been elected a director of Cities Service Oil Co. He is manager of the natural gas division of Cities Service Oil and is a vice president and director of American Gas Production Co.

T. A. VAN GRIETHUYSEN, coordinator of transportation and supplies for Continental Oil Company, is now responsible for the company's pipe line activities in addition to crude oil trading, purchasing and transportation. He will act as liaison with Continental's subsidiary and affiliated pipe line companies.



C. A. Chipman

A. E. Urich

WILLIAM C. KIRKPATRICK has been elected a director of International Petroleum Co. Ltd. Mr. Kirkpatrick joined International in Toronto in 1924 and was transferred to Colombia in 1928. He was transferred to Calgary, Alberta, as chief accountant for the producing and exploration operations of Imperial Oil Ltd. and subsidiary companies in Western Canada in 1939, returned to International's Toronto office in 1945 and was appointed treasurer in 1949.

In 1952 Mr. Kirkpatrick was assigned to Colombia as general manager of Andean National Corp. Ltd., International's pipe line affiliate, returning to International's executive offices in Coral Gables, Florida, early this year.

WILLIAM M. SCHULZ has been promoted to division geologist for the mid-continent division of Cities Service Oil Co. (Del.). He has been geologist for Kansas since June of last year. He will continue to make his headquarters in Bartlesville. Z. E. Stucky has been named assistant to the chief geologist of the company. He has been regional geologist for the northwest division.

F. M. Hoover has been appointed research geologist for the mid-continent division and will continue to make his headquarters in Oklahoma City, where he has been stationed since 1936. Paul Hyatt, who has been headquartered in Bartlesville, will move to Oklahoma City as Oklahoma district geologist.

ALBERT E. URICH has been appointed general manager of purchases for the Gulf Oil Corp. succeeding C. W. Lutz, who was recently promoted to administrative coordinator for the production and exploration department. In his new position, Mr. Urich will be in charge of all purchases made in the United States by all of the Gulf companies, and will be responsible for supervising purchasing policies and procedures for the company's domestic and foreign operations.

A veteran of thirty years of service with the company, he first joined Gulf in 1923. He has been in the purchasing department since 1924.

Technical Cooperation Administration, Washington

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The T.C.A. Agency, United States Government in Washington, has selected British-built CARLISLE GRADERS *in preference to all other makes*—enhancing British prestige, earning valuable dollars — *again proving the superiority of CARLISLE Motorised Graders.*

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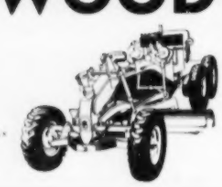

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Orders now in hand for large land installations will result in extensive developments in some tropical areas of international importance.

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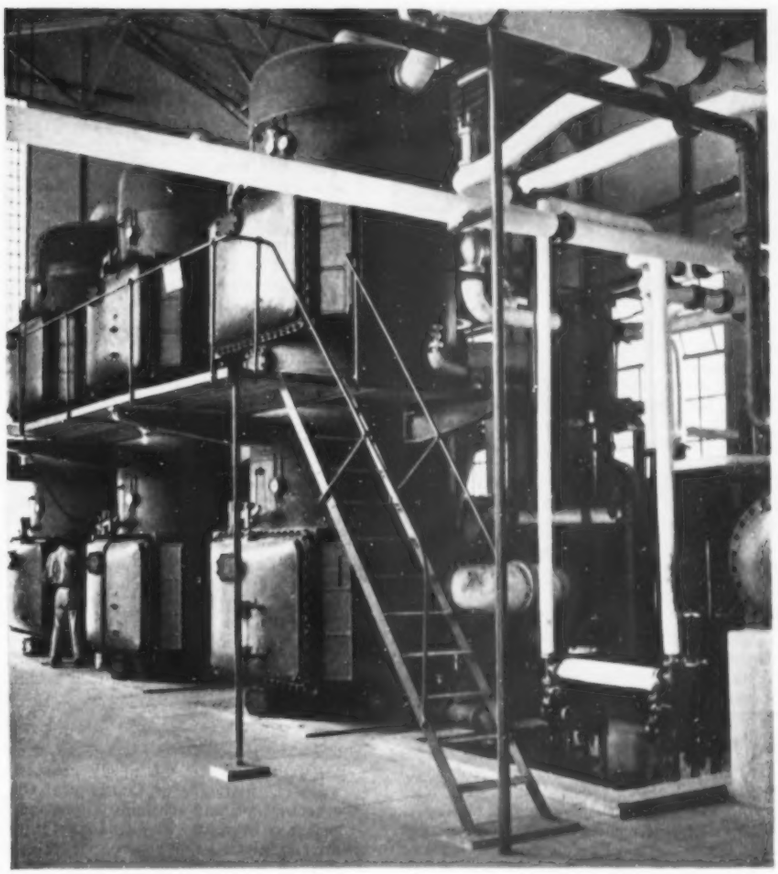

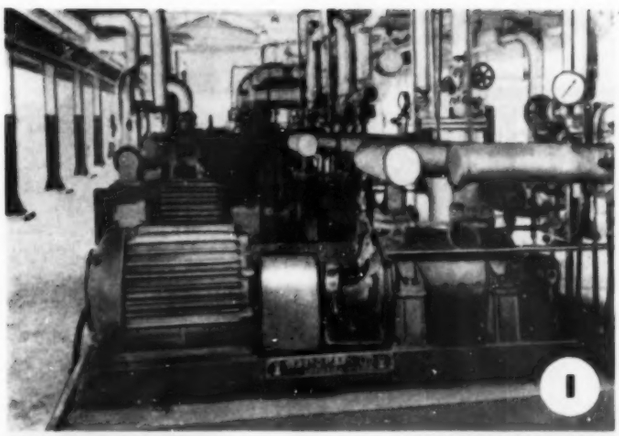

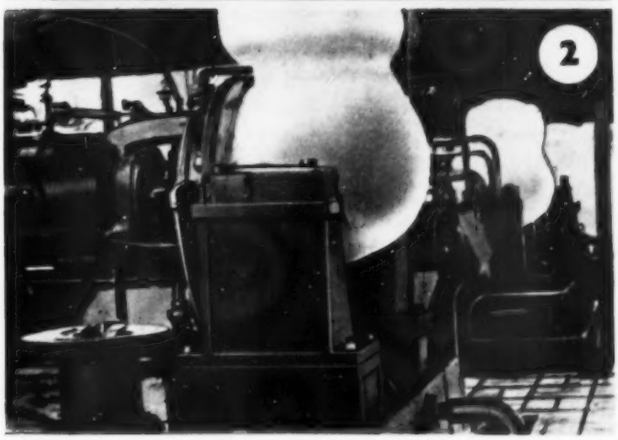

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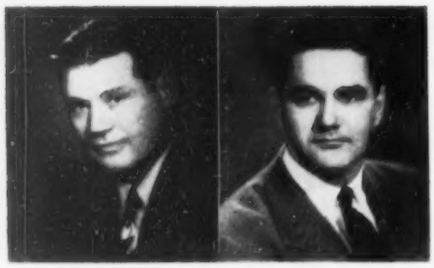

R. L. Van Zandt *S. B. Johnson*

L. G. ALEXANDER, refinery superintendent of International Refineries, Inc., Wrenshall, Minn., has been named vice president and general manager, it was announced by H. M. Baskerville, Sr., president. Mr. Alexander joined International in 1951, after serving six years in Venezuela for the Creole Petroleum Corp.

RICHARD PORTER has been named area gas engineer for Shell Oil Company in New Orleans, replacing J. M. Dillon, Jr., now district plant superintendent of Shell's Elk City, Oklahoma gas processing and cycling plant. For the past two years Mr. Porter has been in Shell's New York office gas technological section.

CLYDE BROWN, who has been associated with Continental Oil Company's oil and gas production operations since 1937, has been promoted to proration engineer for the company's southern region, with headquarters in Houston, Texas.

Conoco also has announced the promotions of C. B. Hickernell and Howard C. Briggs to assistant to the general management of the southern and western regions, respectively. Mr. Hickernell, who has held a succession of positions in Continental's production department for the past 17 years, will make his headquarters in Houston. Mr. Briggs, headquartered in Los Angeles, has been active in Conoco's West Coast production operations since 1927.

ROSCOE L. VAN ZANDT has been named superintendent of the Barton plant, Lion Oil Company's new $31 million chemical plant near New Orleans. Others assigned to management positions at the plant include Stanley B. Johnson, assistant superintendent; John L. Ricks, chief engineer; H. Leo Payton, operating superintendent; Fred B. Elliott, maintenance superintendent; Malcolm C. Lowe, chief chemist; Cary E. Ashley, personnel manager; and Dewey Blackwood, safety engineer. All eight of those named have been transferred from the company's headquarters at El Dorado, Arkansas.

Mr. Van Zandt had six years' experience with other oil companies before joining Lion in 1938 at the company's El Dorado refinery. In 1942 he became production manager of the chemical plant at El Dorado, which Lion operated for the Army Ordnance Department during World War II, and was promoted to assistant superintendent of the plant after it was purchased by the company.

Mr. Johnson joined Lion in 1942 as shift foreman in the company's chemical operations. At the time of his transfer to the Barton plant, he was assistant chief engineer in the El Dorado chemical plant. Mr. Ricks was maintenance and construction superintendent at El Dorado at the time of his transfer.

Mr. Payton joined Lion as a shift foreman at the chemical plant in 1942 and had advanced to supervisor in the El Dorado plant before his transfer. Mr. Elliott is another Lion shift foreman who became a supervisor. Mr. Lowe was employed by Lion in 1942 as a shift foreman and had advanced to the post of chemical engineer at the time of his transfer.

J. W. FERGUSON has been promoted from senior analyst to the newly created position of assistant manager of Continental Oil Company's coordinating and planning department. He will continue to make his headquarters in Houston. Mr. Ferguson was senior natural gas engineer for the U. S. Bureau of Mines at Amarillo for six years prior to joining Conoco in Houston in 1952.

HAROLD A. LOGAN has been made office manager of Sun Oil Company's Rocky Mountain production division at Denver, Colo. His previous post was that of senior auditor in Sun's Dallas, Texas, office, where he had served since 1938.

T. BEN ARNOLD has been appointed superintendent of the Potwin, Kansas refinery of the Vickers Petroleum Co., Inc. Mr. Arnold, for the past three years chief engineer and manager of the refinery division of Southwestern Engineering Co. of Los Angeles, was in charge of construction and installation of the new Vickers TCC unit that went on stream March 20, 1953. A. M. Schrepfer, vice president of manufacturing for Vickers, will continue in charge of overall Vickers refinery operations.

T. B. Arnold

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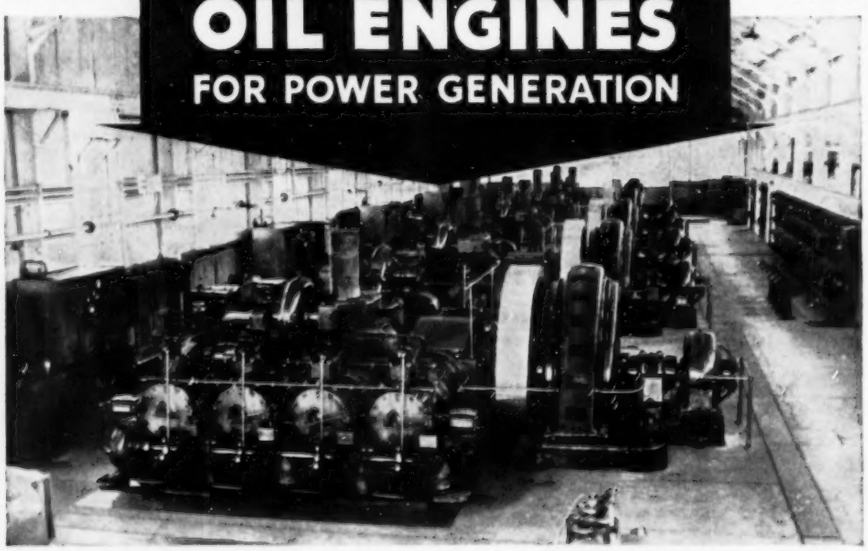

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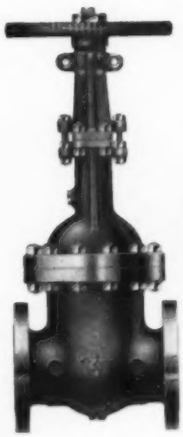

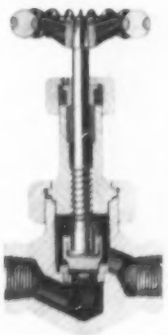

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R. M. MILLER has been appointed assistant manager of the Los Angeles production division of The Ohio Oil Co. W. T. Kennedy has been appointed division superintendent of production of the Los Angeles division succeeding Mr. Miller. Both men will continue to be located in Bakersfield, Calif.

Mr. Miller's recent appointment came on his 48th anniversary with Ohio. He began his continuous employment with Ohio Oil in 1905 as a pumper in Alexandria, Ind.

Mr. Kennedy joined the company in 1930 at Stephens, Ark. where he had been employed as a foreman with the Transcontinental Oil Co. He was appointed assistant division superintendent of the Los Angeles division at Bakersfield in May 1952.

CHESTER U. BURK, Oklahoma City, mechanical engineer for Continental Oil Company's central region, has been promoted to the newly created position of supervising mechanical engineer for the company's production department with headquarters in Houston. A native of Enid, Okla., Mr. Burk received his bachelor's degree in petroleum engineering at the University of Oklahoma at Norman. He joined Conoco in 1949 at Ponca City and transferred to Oklahoma City two years later.

GEORGE A. SCHWAB, manager of the land department for Sunray Oil Corp., retired June 1 after 25 years as manager of the land department activities and a total of 33 years in engineering and land department service in the industry. He is retiring at the age of 52.

E. L. KRUEGER has been elected treasurer and a director of Humble Pipe Line Co. He was formerly secretary and assistant treasurer and will continue to serve as secretary as well as treasurer. In his new duties he relieves C. D. Voss, who retired on June 1 after more than 34 years of service. Mr. Krueger joined Humble Pipe Line Co. in 1923 as a stenographer.

F. E. Rehm

FRANK E. REHM, vice president of Shell Oil Co. and one of the most widely-known men in the oil industry on the West Coast, retired June 1 after 37 years with Shell. For the past decade he has been the Pacific Coast vice president in charge of personnel and industrial relations with headquarters in San Francisco. Mr. Rehm plans to continue in the petroleum industry as secretary-treasurer of the Pacific Oil Institute.

PAUL STEFANIK, formerly chief engineer of the chemical products group of the lubricating department, Socony-Vacuum Oil Co., has been transferred to the lubricating and allied products staff of the company's foreign trade department. His new duties include coordination of chemical products activities in Europe.

Warren A. Beman, formerly in charge of chemical development and by-products activities of the chemical products group, succeeds Mr. Stefanik as chief engineer of this group.

TED A. RUBLE, Amarillo, Tex., manager of Continental Oil Black Co., has been appointed manager of the newly-formed Continental Blacks, Inc., Ponca City, Okla.

He will continue as manager of the Continental oil black plant at Lake Charles, La.

Following a period with Gulf Oil Corporation's refining technology division in Philadelphia, Mr. Ruble joined the research department of Phillips Petroleum Co. at Bartlesville in 1938. He did research work at Bartlesville for 13 years, except for a four-year stint with the U. S. Army's chemical warfare service during World War II, and began his career in the oil black business at Amarillo in 1951.

W. A. BRAMLETTE, Denver, has been appointed assistant chief geologist of The Carter Oil Co. with headquarters in Tulsa. James McCulloch, Vernal, Utah, will replace Mr. Bramlette as western division geologist at Denver. Vernon Farmer was named district geologist at Vernal. Mr. Bramlette joined Carter in 1943 and has done geologic work since that time in Montana, Colorado and the Northwest.

R. G. TRIBBLE of Houston has been named division petroleum engineer for the newly-created Gulf Coast division of Cities Service Oil Co.'s oil production division. He formerly served as engineer in the oil production division at Pampa and Odessa, Texas, and was transferred to Houston as district engineer last year. John Forsyth of Columbus, Texas succeeds him as South Texas district engineer.

A. LUDLOW CLAYDEN, an authority on fuels and internal combustion engines, retired July 1 after 31 years of service with Sun Oil Company. Mr. Clayden joined Sun as chief automotive engineer in May 1922. In 1948 he became head of the automotive laboratory at the Marcus Hook, Pa. refinery and in February of this year became technical associate in the Chemical Research and Development Department.

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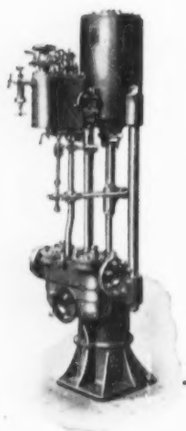

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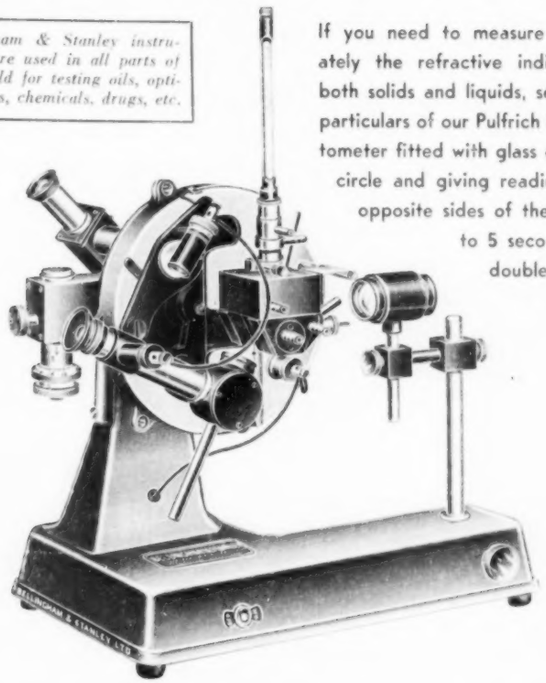

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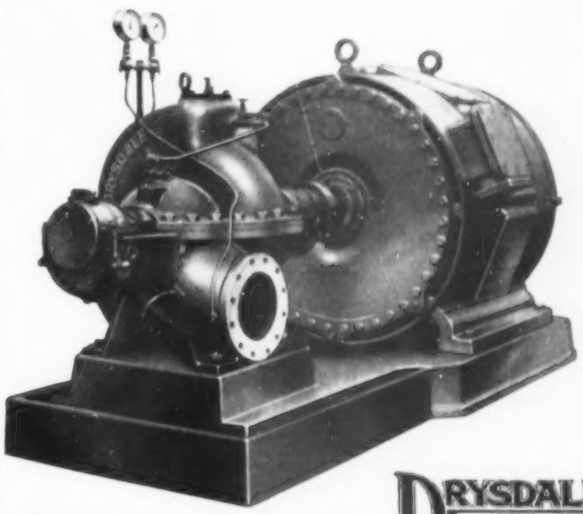

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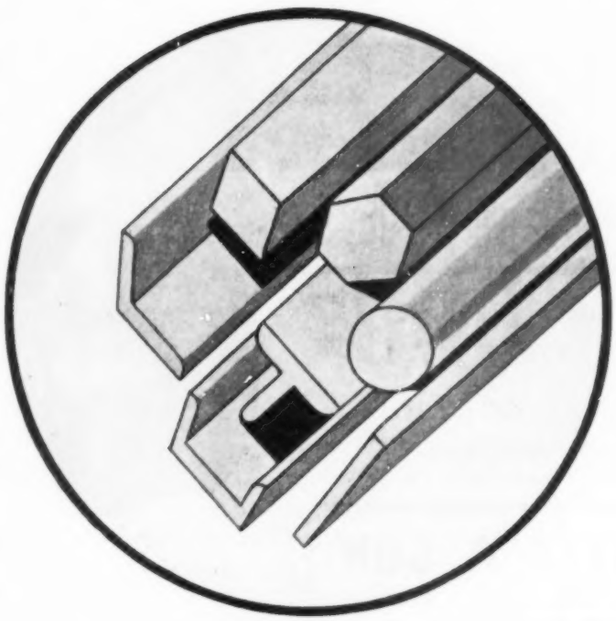

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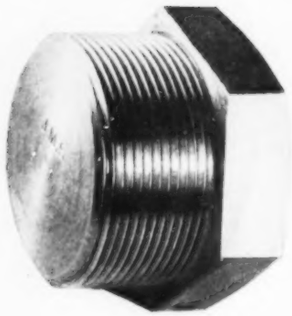

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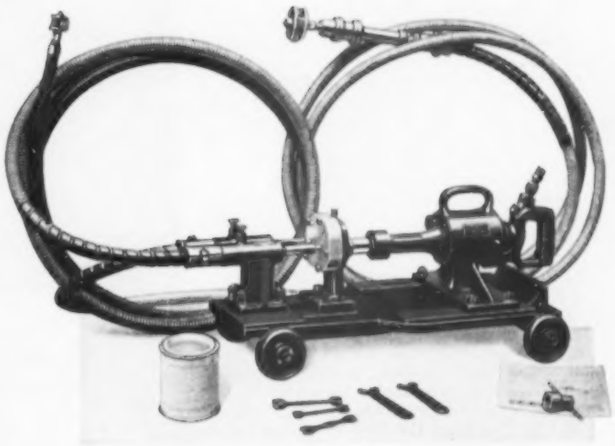

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Canadian Company Organized

Sun-Canadian Pipe Line Company, Ltd. has been organized to construct and operate an eight-inch, 200-mile products pipe line from Sarnia to Toronto. The pipe line will be jointly owned, two-thirds by Sun Oil Company, Ltd., and one-third by Canadian Oil Companies, Ltd. Main offices will be at London, Ont.

William C. Kinsolving will serve as president of the new corporation. He will continue as president of Sun Pipe Line Co. Directors will include also Clarence H. Tew and Douglas Robinson, both of Canadian Oil Companies, Ltd., and John C. Agnew, of Sun Oil Co., Birney K. Morse of Sun Pipe Line Co. and John Blair Moffett, general counsel of Sun Oil Co. Mr. Agnew will be treasurer of the new company.

Construction of the Sarnia-Toronto pipe line has been started, with completion scheduled for around October 1 when Sun's new Sarnia refinery is scheduled to be completed. Estimated cost is approximately $6 million. Initial maximum capacity will be 17,500 barrels a day with a single pumping station at Sarnia. Maximum ultimate capacity would be 35,000 barrels a day with the installation of additional pumping stations.

Each oil company has bulk plants at three points along the line: London, Hamilton and Toronto. A seven-mile spur under Lake Ontario will connect lake marine terminals at Hamilton. The line also will connect the two terminals on the lake shore front at Toronto.

New Caltex Group Tanker

The tanker "S.S. Caltex Perth" was launched June 29, according to an announcement made by The Caltex Trading and Transport Co. Ltd., agents for Overseas Tankship (U.K.) Ltd. The 17,400 deadweight ton ship is the ninth to be launched for Overseas Tankship (U.K.) Ltd. in England. She is 544 feet in length, and is propelled by turbines with reduction gears to give her a trial speed estimated at 15 knots.

H. J. Philp

Canadian Promotion

The promotion of Howard J. Philp to assistant manager of Ethyl Antiknock Ltd. is announced by Oscar B. Lewis, vice president of Ethyl Corporation's Canadian subsidiary which has its headquarters in Toronto. He has been sales representative in Eastern Canada since 1949.

To Drill In Sicily

D'Arcy Exploration Co., prospecting subsidiary of Anglo-Iranian Oil Co., plans to drill a test well in the Vittoria area of Sicily. Since June 1951, when the company was granted permits to search for and produce oil around Ravanusa, Vittoria and Priolo in southern and eastern Sicily, geological, gravity and seismic surveys have been made.

Nunez Visits Europe and Middle East

Luis G. Nunez, advertising and sales promotion manager of Westinghouse Electric International Co., left recently on a two-month trip through 13 countries of Western Europe and the Middle East. Countries on Mr. Nunez' itinerary are Egypt, Syria, Lebanon, Turkey, Greece, Italy, Switzerland, West Germany, France, Belgium, England, Spain and Portugal. He will return to New York early in September.

Head Offices Moved

Brooks & Walker, Ltd., engineers' suppliers, moved their head office from 41 Dockhead, London, S.E.1 to 47 Great Eastern St., London, E.C.2 on June 1. The new premises provide bigger and better facilities.

Fluor Buys Canadian Interest

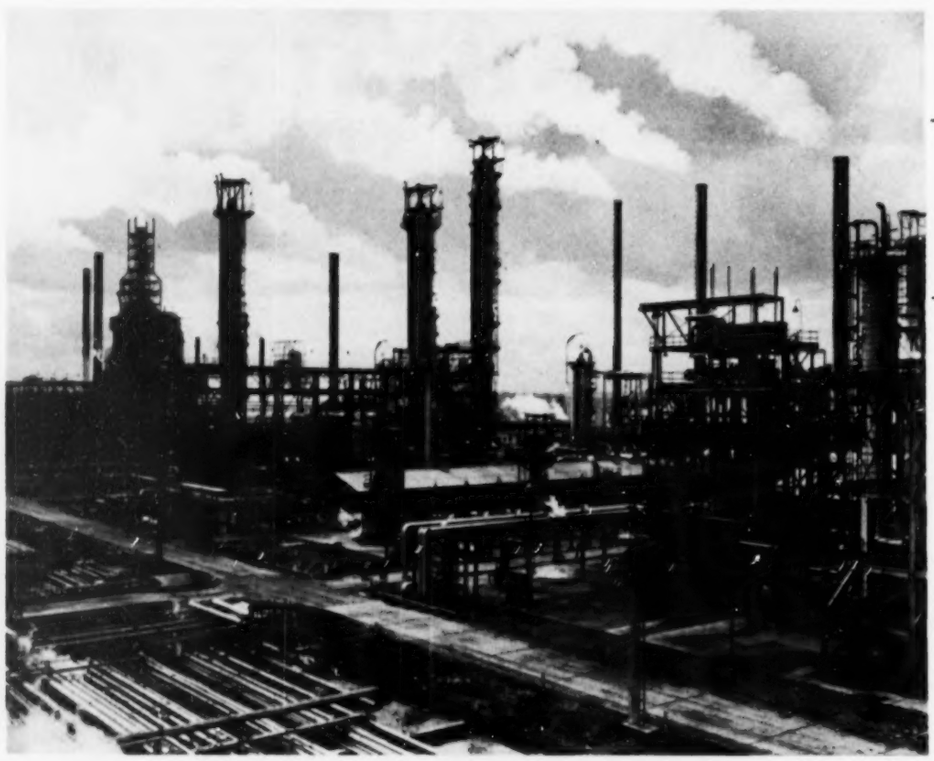
Further integrating its engineering and construction services in Canada, the Fluor Corporation of Canada Ltd., has purchased an interest in H. G. Acres & Company, consulting engineers, of Niagara Falls, Ont.

Fluor of Canada is one of the subsidiaries of the Fluor Corporation Ltd., of Los Angeles. No change in policy, management, personnel, or company name of the Acres company is contemplated.

S. W. Andrews is president of Acres, and has been associated with that company since 1924. A. W. F. McQueen is vice president. Other directors include James P. Wiseman, president of Fluor of Canada; John G. Marshall, vice president of Fluor of Canada; and P. J. B. Lash of Toronto.

Fluor of Canada is currently designing and building large refinery additions for Imperial Oil Ltd., at Regina, Sask., and for Shell Oil Company of Canada Ltd., at Vancouver, B. C. Future engineering of this type will be handled by Acres, with Fluor responsible for construction.

The Acres company was founded by the late Henry G. Acres in 1924.



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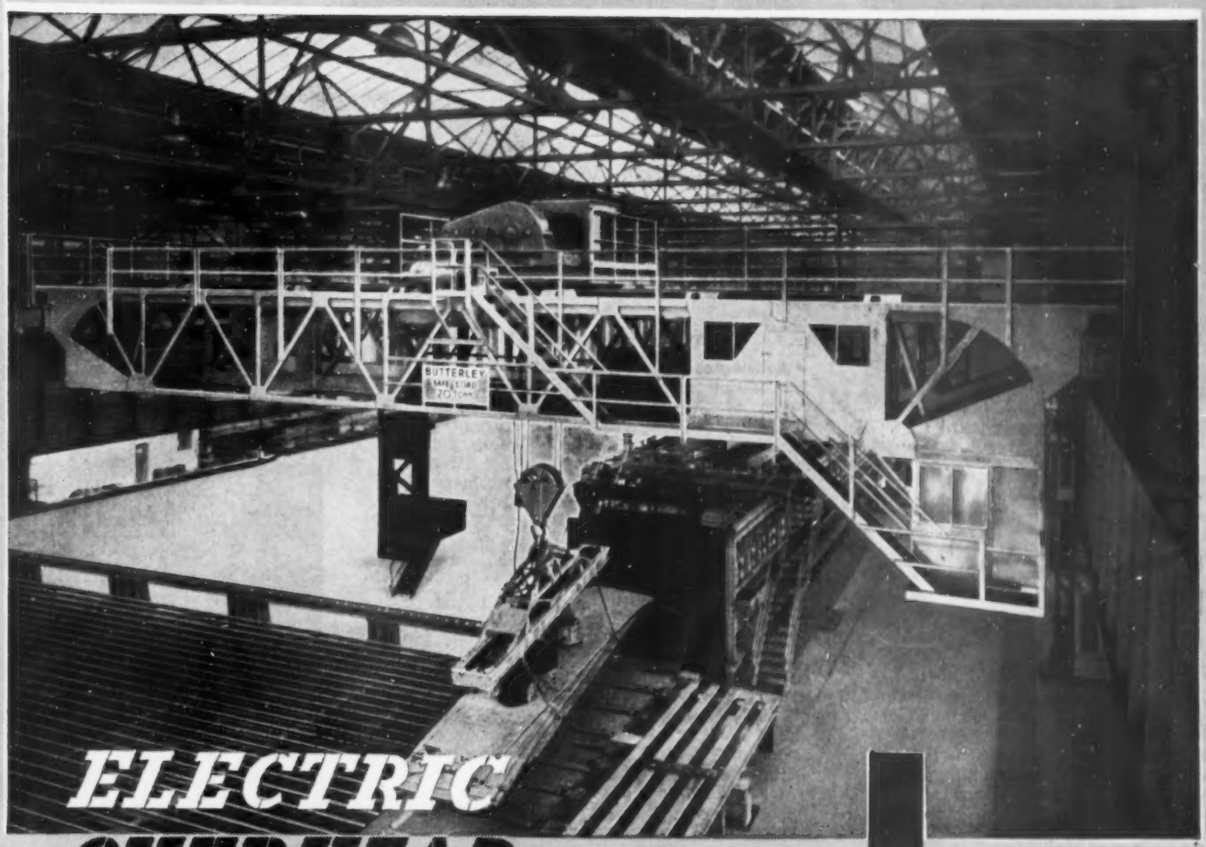

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Cat Cracker Compressor

Assembly of the new Clark multi-stage centrifugal compressor to be used as the main air compressors on four of the country's new huge cat crackers now under construction. These compressors have a rated capacity to 100,000 cfm and will be driven by steam turbines of approximately 8,000 bhp. Some idea of their size is their overall weight of 70 tons. The approximately 4½ feet diameter rotors will run in the 3,600 rpm speed range.

Sulfur Plant Operating

A new sulfur recovery unit of Gulf Oil Corp. placed in service June 12, 1952 at the Waddell natural gasoline plant has produced 12,750,000 pounds in its first year of operation. It has a rated capacity of 44,000 pounds daily, and recovers about 90 percent of the elemental sulfur contained as hydrogen sulfide in gas coming into the plant.

Sulfur output is delivered in hot, molten form direct by truck to a fertilizer manufacturer at Odessa, 20 miles away.

Heads GATX Office

Edward D. Rollins has been appointed western manager of General American Transportation Corporation's new plate and welding division sales office in San Francisco. The San Francisco office has been opened to serve potential clients for the new steel fabricating plant now nearing completion at Orem, Utah.

Inductrol Power Packs

A new 8-page illustrated bulletin (GEA-5928) on Inductrol Power Packs, for a-c lighting and power service up to 112.5 kva, 600 volts and below, has been announced as available by the General Electric Company, Schenectady 5, New York.

Three-Way Fire Truck

A new fire truck equipped with three different fire-fighting mechanisms was demonstrated recently at the Richfield Oil Corp. refinery in Wilmington, Calif. With some 200 fire-prevention officials and safety engineers watching, a 40-man crew demonstrated the truck's three different fire-fighting methods, singly and in combination, extinguishing billowing oil and gas fires in a matter of seconds.

The first method brought into play a 2,000 pound Ansul dry chemical tank from which four hose lines sprayed a compound of sodium bicarbonate and other chemicals at the rate of 1,300 pounds per minute. This device, the latest for combatting inflammable liquid fires, works by literally smothering the flames, and is especially effective in putting out fires atop flues, gas tanks and other inaccessible places.

Supplementing the Ansul tanks was an 800-gallon tank filled with high-expansion liquid foam, and a water pump, powered by a 285 hp engine and capable of pumping 2,800 gpm of water through eight additional hose lines. The foam, mixed with water, forms a "blanket" to smother flames on horizontal surfaces such as the ground. Water can also be used separately as a cooling agent to prevent gas and oil fires from spreading.

Corrosion Booklet

Results of 27 years of continuous laboratory research and field study of the nature of corrosive attack on copper and copper alloys conducted by The American Brass Company's technical staff have been published in a new 28-page booklet, "Corrosion Resistance of Copper and Copper Alloys." This publication, first of its kind in the industry, explains the chemical and physical nature of corrosive attack in its various forms. The booklet, publication B-36R, is available without charge from The American Brass Company, Waterbury 20, Conn.

Westinghouse Expansion

Westinghouse Air Brake Co. has purchased the earth-moving and related business of R. G. Le Tourneau, Inc., including all fixed assets and machinery at Peoria, Illinois, Toccoa, Georgia, and its interest in the Australian subsidiary for approximately $19,500,000. The announcement follows closely the purchase by Westinghouse of the George E. Failing Co. of Enid, Okla., and the Le Roi Co. of Milwaukee.

Part of the 40-man crew of Richfield refinery's unique dry chemical fire truck shown extinguishing a 20-foot gasoline tank fire in one minute and 44 seconds.

Aviation Spirit Pump
Eminently suitable for handling spirits and other volatile fluids, this Screw Displacement Pump is of the all round clearance design and is capable of working with a high suction lift. The flow is practically pulseless and the unit self priming.
STOTHERT & PITT LTD BATH ENGLAND
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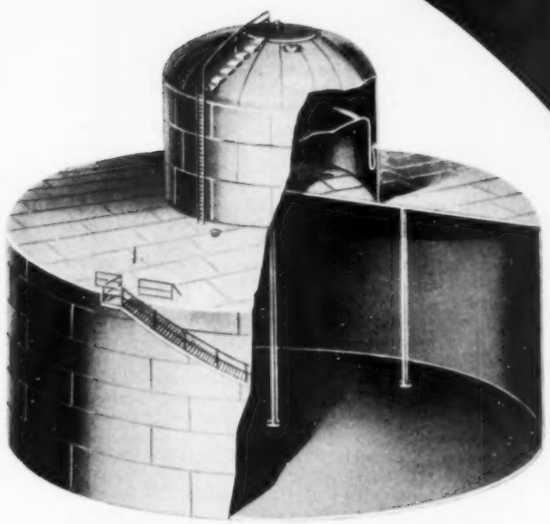

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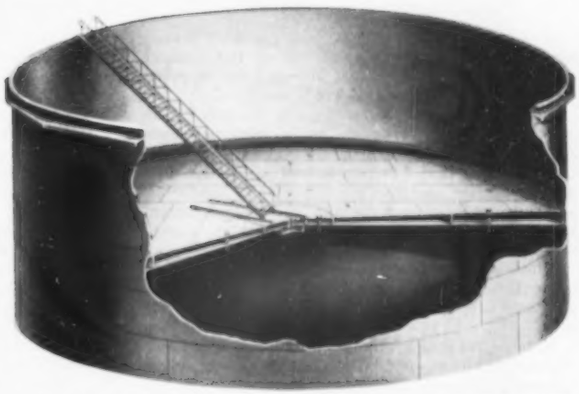

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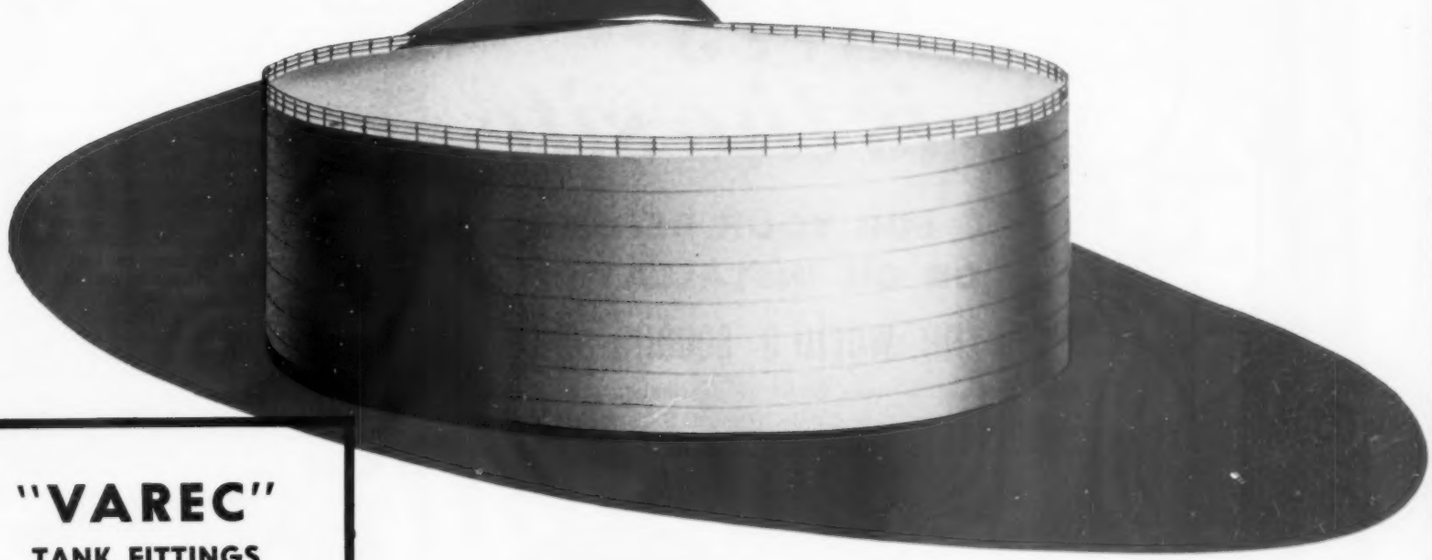

"VAREC"
TANK FITTINGS

Wm Neill & Son (St. Helens) Ltd., with a view to extending their service to the Petroleum Industry, have entered into an agreement with the Vapor Recovery Systems Company of Compton, California, U.S.A., to manufacture in Britain certain "Varec" tank fittings and accessories.

The Company feel sure, from their past experience, that the items will fill an outstanding want, particularly in so far as purchases of Petroleum Equipment in Britain are concerned.

Wm Neill & Son's usual high standard of workmanship will be fully maintained in the manufacture of these latest additions to their range of supplies.

All enquiries will receive careful attention.

AS one of the leading British designers and manufacturers of storage Tanks and Petroleum Equipment, we now offer with considerable pleasure additions to our extensive range of tankage and vapour conservation methods.

These include: — "Neill Hammond" Double Deck Floating Roof Tanks, the "Neill Hammond" Pontoon and Pan type Floating Roof Tanks, also "Hammond Dialift" designed for the reduction of evaporation losses in existing as well as new storage.

We have for many years been established as leading designers and manufacturers of Cone Roof, Bolted and Underground Tanks to our special and standard designs, Fractionating Towers, Heat Exchangers, Pressure and Vacuum Vessels, etc., and have manufactured and erected some of the largest Oil Storage terminals in the World.

We will gladly mail (on request to our London Office) Brochures on "Neill Hammond" Double Deck, Pontoon and Pan type floating roof tanks, together with a detailed brochure of the Hammond Dialift, —also if desired, we will mail you a copy of our brochure on "Varec" fittings and vapour conservation equipment, and tank gauging equipment.

Your enquiries would be welcome, and will receive prompt and careful attention.

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Pipe Fabrication Described

A detailed description of how pressure piping is fabricated for industrial use is the subject of a 16-page brochure just released by Western Piping Supply Division of The Lummus Co.

Titled "Meet Western Piping Supply," the booklet takes the reader on a pictorial tour through the company's East Chicago, Indiana, fabricating plant. Pictured and described are shop facilities and the steps taken in producing pre-fabricated piping for the power generation, petroleum refining, pipe line transmission, paper, steel, chemical and heavy industries.

Illustrations show various assemblies being made from carbon and alloy piping, and demonstrates the blending of large-diameter, heavy-wall pipe.

Free copies are available from Western Piping Supply Division, 504 West 145th Street, East Chicago, Indiana.

Viscosity Standardization Change

The National Bureau of Standards adopted a new value for the viscosity of water on July 1, 1953. As a result of the research conducted by Messrs. J. F. Swindells, J. R. Coe, Jr., and T. B. Godfrey,[1] a new value of 1.0038 centistokes at 68°F has been established in place of 1.0070 centistokes at 68°F, the value currently in use.

Accordingly, extensive revisions to Viscosity Methods and tables will be required. The ASTM Committee D-2 on Petroleum Products and Lubricants is currently preparing the necessary revisions to the viscosity standards and tentatives affected. (D445, D466, D666 and D567.)

The National Bureau of Standards initially proposed to adopt this new kinematic viscosity value on July 1, 1952 but, at the request of Committee D-2, granted a full year's delay in order to give proper publicity to the project and to give those concerned an opportunity to study the subject. Method D445-52T will be revised to cover the new adopted value on July 1, 1953.

Changes in viscosity measurements will be affected and changes in standards will be necessary. All kinematic viscosity measurements, for example, will be reduced by 0.318 percent. Saybolt Universal and Furol Viscosities, however, will not be affected. This means that viscosity conversion tables ASTM D446 and ASTM D666 will require revision. The new tables will be available from ASTM headquarters after June 1, 1953.

The table of basic kinematic viscosity values for computing Viscosity Index will also require changes. This table, found in ASTM Method D567, will be revised so that the Viscosity Index of a given oil will not change because of the adoption of the new standard value for water. Revised copies were made available June 1, 1953. The table of basic Saybolt viscosity values for computing Viscosity Index will remain as at present.

Prepared booklets showing calculated Viscosity Indices for basic kinematic viscosity values similar to those issued by the Standard Oil Development Co. will also be revised to provide for the new values and will be available at ASTM headquarters later this year.

All kinematic viscometers in use will require restandardization or recalibration. Kinematic viscometers which have C-constants that are not simple numbers (i.e., 0.1, 0.3, 0.5, etc.) may be restandardized or recalibrated merely by multiplying their present factors by 0.99682 (or $\frac{1.0038}{1.0070}$). However, a more complicated procedure will be required where the C-constants are simple numbers, since the physical dimensions control the value of C and any one or all of the dimensions may have to be adjusted if it is desired to retain the simple number C-constant.

The value of secondary standard oils in use by laboratories will also have to be reduced by 0.318 percent. The National Bureau of Standards will revise the values of the viscosity standard oils they distribute as of July 1, 1953. In addition, the American Petroleum Institute viscosity standard oils Alpha, Beta and Gamma will have their viscosity values revised as of the same date. Any standards on hand received prior to July 1, 1953 should have the values on the labels reduced by 0.318 percent to conform to the adopted value.

In summary, then, the following will be established as of July 1, 1953:

1. The kinematic viscosity of water at 68°F will be 1.0038 centistokes.
2. All kinematic viscosities will be reduced by 0.318 percent.
3. All kinematic viscometers will require restandardization or recalibration.
4. No changes will be required in Saybolt viscosities or viscometers.
5. Present conversion tables showing kinematic viscosity to Saybolt Universal and Furol Viscosities will be invalidated. Corrected tables will be available at ASTM headquarters after June 1, 1953.
6. Present basic kinematic viscosity values for computing Viscosity Indices will be invalidated. Corrected tables may be obtained from ASTM headquarters after June 1, 1953.
7. All Secondary Standard Viscosity oils will require restandardization.

For further information, contact ASTM headquarters.

[1] J. F. Swindells, J. R. Coe, Jr., and T. B. Godfrey, "Absolute Viscosity of Water at 20° C.," *Journal of Research of the N.B.S.*, Vol. 48, No. 1, Jan. 1952. Research Paper 2279.

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In 1952, 2½ million tons of petroleum were handled at Avonmouth. During 1945 imports alone topped 4¾ million tons—a world record.

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S. T. Childress

Sid T. Childress, 65, Houston, vice president and general manager of the Rio Bravo Oil Co. who started his career as a roustabout in the old Spindletop field near Beaumont, Texas in 1909, died June 20. A native of Garland, Texas, Mr. Childress had a wide and varied career in the oil industry. He worked as a tool dresser, driller, gang pusher and production foreman for such companies as Gulf, Texas, Rycade and others before joining the Rio Bravo as foreman in 1927. He had been vice president and general manager since 1935.

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To License New Process

The M. W. Kellogg Co. has been appointed licensing agents for the new catalytic reforming process developed by Sinclair Refining Co. and Baker & Co., Inc.

The platinum-bearing catalyst, called RD-150, was developed through cooperative research by Sinclair and Baker. It is a regenerative type of catalyst and maintains high activity over long periods of time. Sinclair pilot runs indicate that the new Baker catalyst can produce excellent yields of high octane product from a wide variety of feed stocks.

The new Kellogg process for employing the catalyst will be of the fixed-bed type of a new design specially developed for the Baker catalyst. In this connection, Kellogg pointed out that its interest in the new catalyst and process does not affect its position in regard to its molybdenum catalyst reforming process, Fluid Hydroforming, which will continue to be offered for particular applications.

Baker and Co. is currently producing the new platinum catalyst in its Newark, N. J. plant. A new plant is being erected in New Jersey to produce vastly increased supplies to meet the expected demand for the catalyst.

Appointed Bechtel Corp. Assistants

D. K. Finlayson of New York and Wilson E. Arthur of Los Angeles have been appointed assistants to Vice President Charles T. Draney of Bechtel Corp. Both men will assist in business development. Mr. Finlayson will have headquarters at Bechtel eastern division offices in New York, and Mr. Arthur on the Pacific Coast.

Ceramic Pump Plungers

Ceramic plungers for reciprocating pumps are the subject of bulletin No. W-404-B-5 being offered by Worthington Corporation, Harrison, N. J. Chemical and physical properties of the plungers are described.

E. H. McGrew

Technical Director Named

New technical director of the rapidly expanding catalyst division of National Aluminate Corp. is E. H. McGrew, formerly of Universal Oil Products Co. He will assist Dr. D. G. Braithwaite, assistant vice president of Nalco. Mr. McGrew has been actively involved in both development and operation of the catalytic cracking processes since 1939.

Join National Petroleum Council

Three new men have taken places on the National Petroleum Council, top industry group which advises the Secretary of the Interior. They are D. T. Staples, president of Tide Water Associated Oil Co.; Nelson Maynard, president of the National Congress of Petroleum Retailers, Inc.; and Frank M. Perry, president of the Natural Gasoline Association of America.

Du Pont Personnel Changes

Ray E. Miller has elected to give up active direction of sales of the Petroleum Chemicals Division of the du Pont Company for reasons of health, and will be succeeded as director by David H. Conklin, assistant director of sales. Mr. Miller will continue in the Petroleum Chemicals Division as advisor to the director of sales.

Mr. Conklin will be succeeded as assistant director of sales by Milton H. Campbell, head of the Petroleum Research Division of Jackson Laboratory, Deepwater Point, N. J.

Mr. Miller has had more than 30 years of experience in the oil industry. In 1920 he became safety engineer and personnel manager for the Marland Oil Co., now Continental Oil Co. Eight years later he was named executive secretary of the Natural Gasoline Association of America, and in 1943-44 was president of that organization. In 1934 he joined Hanlon-Buchanan, Inc., a Tulsa oil company, as a vice president—a post he held until becoming vice president and director of the Warren Petroleum Corp. early in 1946. He joined the du Pont Company on Sept. 1, 1946 as sales director for petroleum additives, and later became sales director of the Petroleum Chemicals Division.

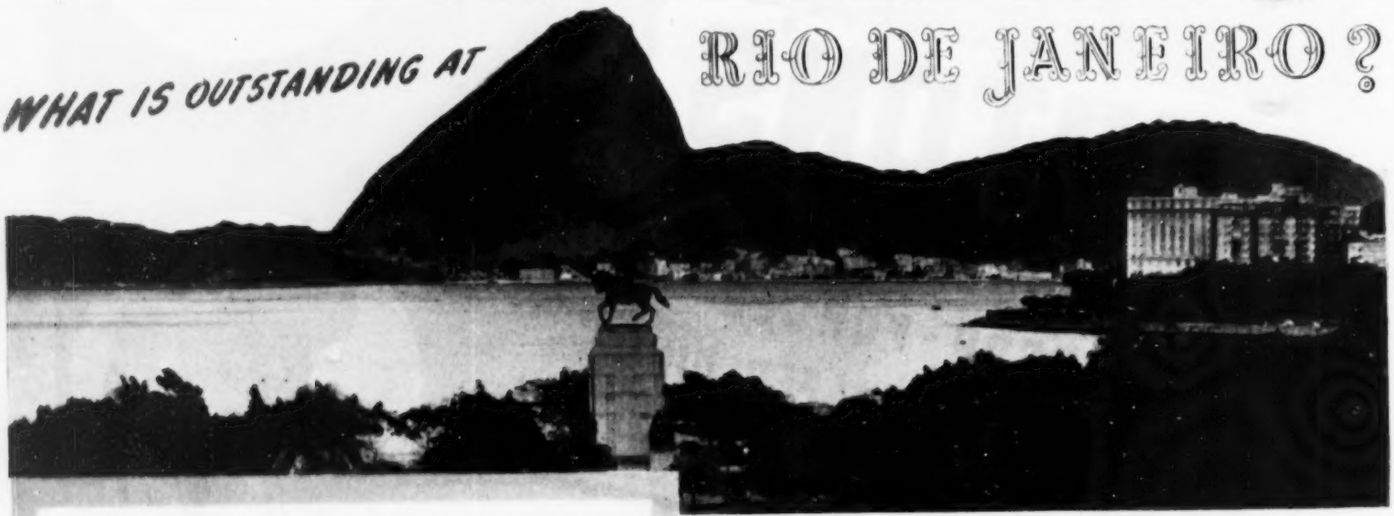
New Graver Plant

Graver Tank & Manufacturing Co., Inc., East Chicago, Indiana, has opened a new plant at Odessa, Texas. This brings to six the total number of Graver plants. Extensive warehouse space at Odessa will permit storing of well-head equipment manufactured at Sand Springs and shop-built lease tanks of 550-barrel and 1,000-barrel capacities fabricated at Odessa.

Heads Roots Blowers

Ralph R. Newquist has been elected president and general manager of the Roots-Connersville Blower Division of Dresser Industries, Inc. He succeeds R. H. Owens, who becomes chairman until his retirement later this year.

WHAT IS OUTSTANDING AT RIO DE JANEIRO?



The "sugar loaf" mountain, admittedly. International paints fit the Brazilian scene equally well in their own way.

The on-the-spot experience of the associated company in Rio and the accumulated technical knowledge of the central factory at Felling-on-Tyne, England, combine to produce the right paint for every job.

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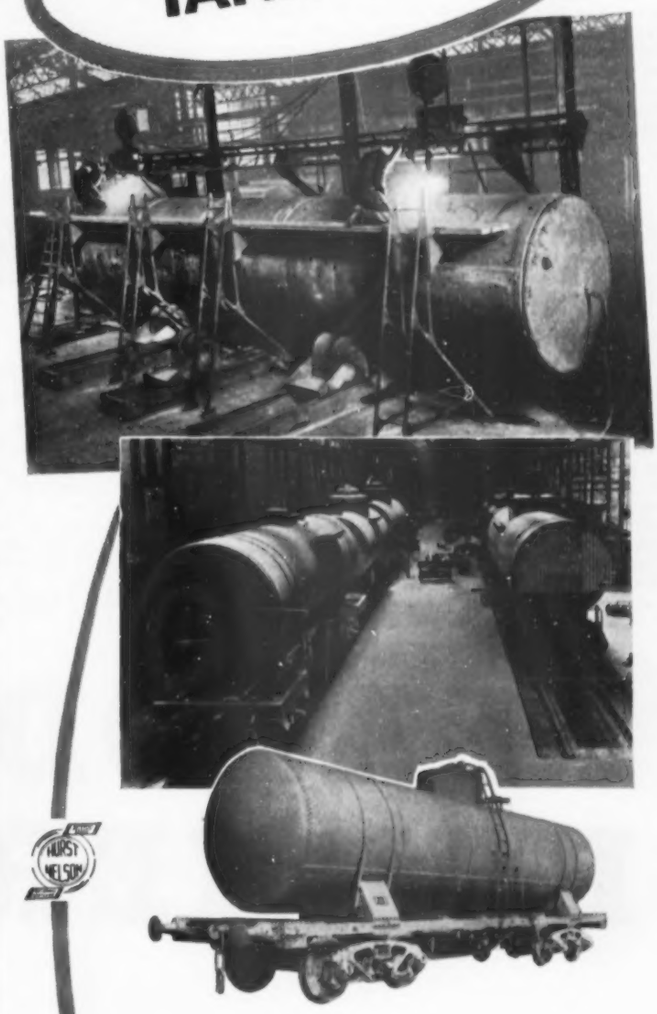

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Elected Director of Fluor Corp.

Jan Oostermeyer, former president of Shell Chemical Corp., has been elected a director of the Fluor Corporation Ltd. of Los Angeles. Mr Oostermeyer's retirement from Shell was announced June 1. Born in Amersfoort, Holland, he began his oil industry career in 1917 with the Asiatic Petroleum Co. in China. He spent 20 years in the Orient before taking up new duties as assistant manager for Shell at Santiago, Chile, in 1937.

In 1939, he became assistant to the president of what was then the Shell Chemical Co. and advanced to the presidency in 1942. Mr. Oostermeyer guided the huge $50 million Shell petroleum chemicals expansion program, including the first commercial production of synthetic glycerine. For its work in this field, Shell was awarded the Chemical Engineering Achievement Award in 1948.

Educational Oil Exhibit

Sun Oil Co. has installed a new permanent exhibition in Philadelphia's Franklin Institute to describe how the petroleum industry operates and its impact upon American living. Designed to win better understanding of the American economic system, the exhibition, titled "Oil Serves America," was formally opened with a preview for educational, business and other community leaders.

Planned in connection with Sun's program of cooperation with educators for a better understanding of American competitive enterprise, the new exhibition is a self-contained, airconditioned unit occupying 2,900 square feet on the first floor of the museum.

Within this area are 12 separate exhibits, utilizing a variety of modern devices in visual education, including models, dioramas, and animated diagrams. Also included in the unit is a theater, seating about 40 persons, for the screening of motion pictures, lectures and discussions.

J. Oostermeyer

Platformer Sets Two World's Records

The UOP Platformer at Johnson Oil Refining Co., Cleveland, Okla., has set two world's records since it went on stream June 22, 1951, a year after the contract for construction was awarded to Procon, Inc. It is still operating on the initial catalyst charge and has operated 97.6 percent of the time that the refinery has been in operation.

When the Platformer completed its second year of operation on June 21, it had processed approximately 1,050,000 barrels and produced 971,500 barrels of Platformate. During the two years, the unit has charged more than 167 barrels of reactor charge for each pound of the original catalyst. The cost for the catalyst is under 2.4 cents per barrel charged. There has been little change in yield-octane relationship.

Since it went on stream, the unit has been down only 17 days for cleanout and inspection as well as for a short time during the nation-wide strike which hit the petroleum industry.

Following is a summary of charge and product inspections characteristic of the current operation:

Reactor charge, b/d	1,688
Platformate yield vol. % of charge	93.0
INSPECTIONS	
Platformate	
Octane Numbers: F-1 clear	79.0
plus 3 cc TEL	92.5
API	58.1
Reid vapor pressure	8.5
Initial boiling point	90
10%	140
50%	240
90%	330
End Point	398
Reactor Charge	
Octane Numbers: F-1 Clear	45.6
plus 3 cc TEL	66.5
API	56.1
Reid vapor pressure	1.5
Initial boiling point	175
10%	212
50%	270
90%	329
End Point	380

Westinghouse Promotions

G. L. Wilcox has been appointed vice president-operations and J. D. Mickle general sales manager of Westinghouse Electric International Co. Mr. Wilcox formerly was vice president-sales.

Mr. Mickle, who will direct all the sales activities of the company, was previously director of the American area sales.

PEABODY BURNERS

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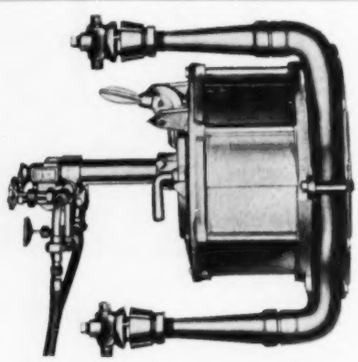

The illustration shows a typical Peabody combined Premix Gas and Oil Burner for oil refinery use. The premix gas burner can deal efficiently with rich, dirty refinery gases and the steam atomising oil burner will burn oils up to the heaviest residues.

Peabody Burners are installed in many thousands by petroleum refineries throughout the world and are truly *worldwide*

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CHEMISTRY OF PETROLEUM DERIVATIVES—Carleton Ellis Vol. I	$20.00
Vol. II	$22.50
CONVERSION OF PETROLEUM—A. N. Sachanen	$12.00
CHEMICAL REFINING OF PETROLEUM—V. Kalichevsky & Stagner	$ 8.25
CHEMICAL ENGINEERS' HANDBOOK—John H. Perry (revised 3rd edition, 1950)	$17.00
CORROSION (Causes and Preventions)—Frank N. Speller	$10.00
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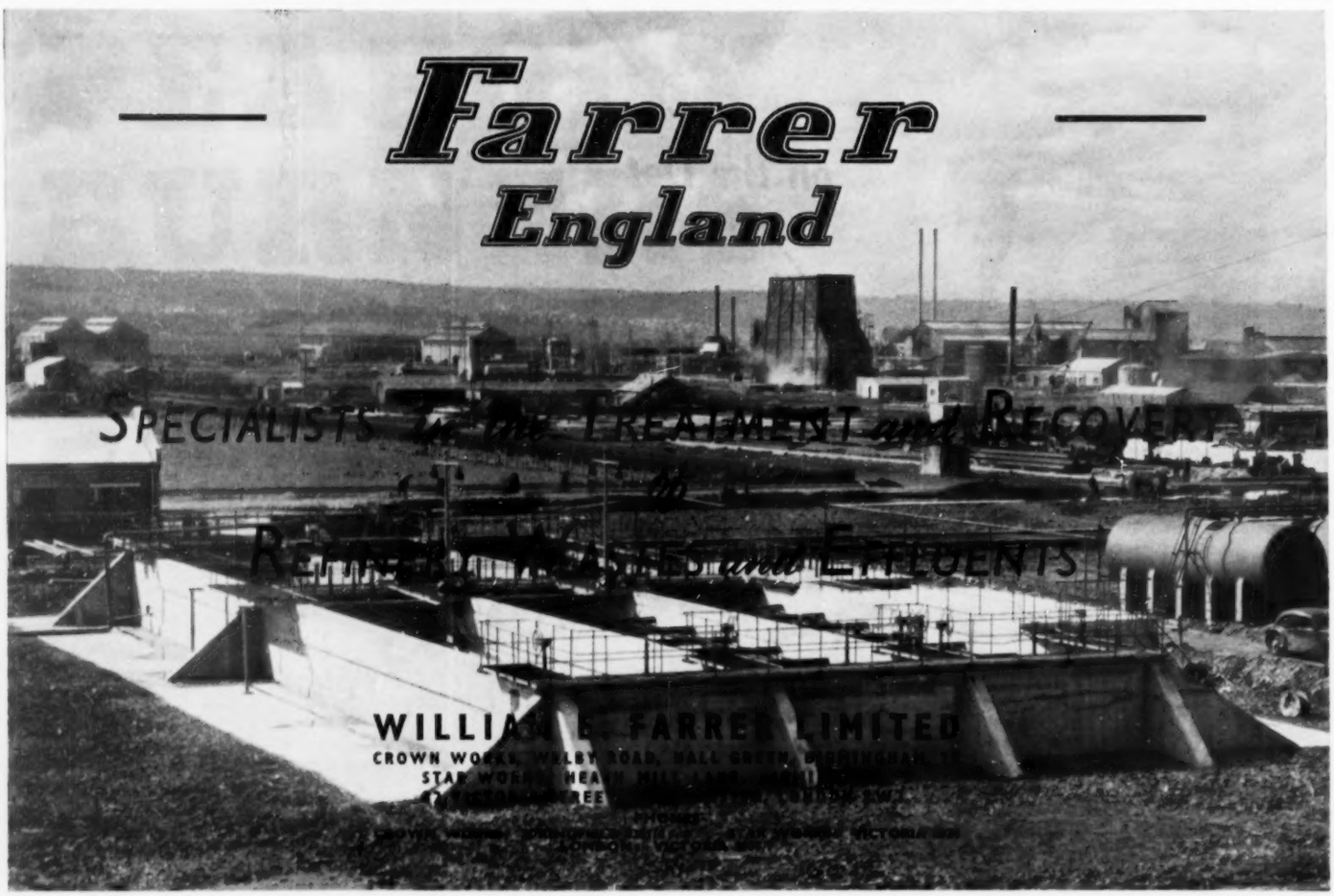


Hydrogen Desulfurization Processes

(Continued from page 96)

beds. Sulfur content of the stock being treated and the extent of sulfur to be removed will affect reactor design and operation. With low sulfur stocks, intermediate injection of raw cold oil may be omitted. More reactor beds are required for the treatment of very sour distillates.

Effluent from the reactors at about 715°F is cooled in exchange with charge and passed through a high pressure separator for removal of recycle gas. Hydrogen sulfide is removed from a second low pressure separator before product fractionation where final H_2S separation is effected. Fractionation of the unit product yields a quantity of high octane gasoline and kerosine side cut as well as desulfurized gas oil.

Operating on Middle East cracked cycle stock, Shell researchers have reduced sulfur content 85 percent. Weight percent of sulfur in raw charge of 2.9 was cut to 0.01 in the product boiling below 430°F; to 0.02 in the 430-500°F fraction; 0.34 in the 430°F plus cut and 0.43 in the product boiling above 500°F.

Operating cost of processing Middle East straight run gas oil to remove 85 percent of the sulfur is estimated at 11.9 cents per barrel. Catalytically cracked gas oil from Middle East crude will cost 16.3 cents per barrel to process.

In the case of straight run gas oil, 100 percent yield is obtained with 40 cubic feet of H_2S per barrel of charge as a by-product. The gas may be processed for sulfur recovery. When processing catalytically cracked gas oil, 38 gallons of gas oil and 4.5 gallons of heavy gasoline component are obtained plus 95 cubic feet of H_2S per barrel of charge. No light ends are produced to create a product loss.

Carbon deposition on the catalyst is quite low. It is anticipated that regeneration once a year will be sufficient.

In many applications, it is estimated that catalytic reforming of the naphtha fraction will supply enough hydrogen to hydrodesulfurize the gas oil fraction. Platforming, for example, produces about 500 cubic feet of hydrogen per barrel of naphtha charge.

A hydrofining unit currently is under construction at the Linden, N. J., refinery of Esso Standard Oil Co. This unit will have a charging capacity of 21,500 b/d. Design was by Standard Oil Development Co. with C. F. Braun as contractor. It is understood that the Esso unit will be used largely to desulfurize gasoline, kerosine and domestic heating oils. Plan is to have the unit on stream late in 1954. Esso has built a hydrofiner to process tractor fuel at Fawley, England. Sulfur is recovered in a Claus kiln at this installation.

Events of the past year make it clear that a revolution in methods of treating both light and heavy distillates is in progress. An important factor in the development has been the production of large volumes of by-product hydrogen.

U. S. Refining Capacity

(Continued from page 150)

Union Oil Co. of Calif. is improving its shipping facilities at both Oleum and Los Angeles refineries. At both points wharfage and terminal equipment jobs are beginning currently. Cost of the two jobs will approximate $7 million.

Brea Chemicals, Inc., a newly organized subsidiary of Union Oil Co., will lease and operate an ammonia plant now under construction by Braun at Brea, 30 miles east of Los Angeles. Amoniaco Corporation, a non-affiliated company, is financing the specially designed $13 million petroleum-research center opened by Union in 1952.

Recital of the foregoing major construction jobs current in the United States emphasizes the amount of money which the industry must invest in new plants and equipment year by year in order to keep abreast of expanding consumption. An increase of roughly four percent per annum in demand requires a similar construction program from the standpoint of volume alone, plus a large building program to replace worn-out and obsolete capacity.

Nordstrom Valve Booklet

A new bulletin, V220, describing lubricants, lubricant fillings and lubrication methods for Rockwell-built Nordstrom valves, has been issued by Rockwell Manufacturing Co., 400 No. Lexington Ave., Pittsburgh 8, Pa. A "selection chart" is offered showing which lubricants are recommended for use with a variety of fluids. The bulletin gives instructions for servicing valves.

Retires After 29 Years With API

Carl A. Young, of Dallas, Tex., was given a "king-size" farewell party early in June at the Pacific Coast district meeting of the American Petroleum Institute's Division of Production in the Statler Hotel. Mr. Young, who has been with the Institute for 29 years and has been director of the Production Division since its organization, retired July 1.

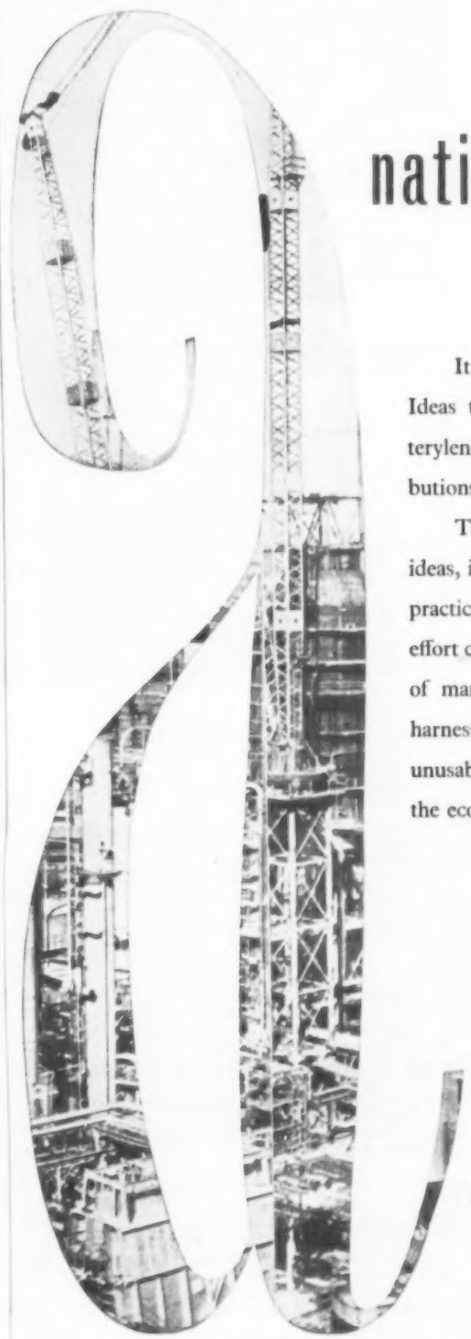
Consolidated Engineering Promotions

Hugh F. Colvin has been elected vice president and general manager of the Consolidated Engineering Corp., Pasadena, Calif. Robert L. Smallman was elected vice president in charge of sales, and Victor Pollock was chosen treasurer.

Broding Joins Century

The addition of R. A. Broding as vice president of Century Geophysical Corp., Tulsa, effective June 1, has been announced by Opie Dimmick, president of Century.

Mr. Broding joined Magnolia Petroleum Company in 1939. During World War II he served three years with the Naval Ordnance Laboratory in Washington, D. C. Since 1949, he has been research associate in Magnolia's Research and Special Instrumentation Group.



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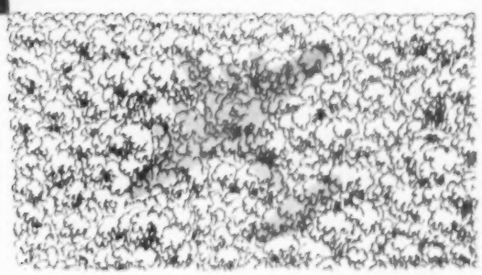

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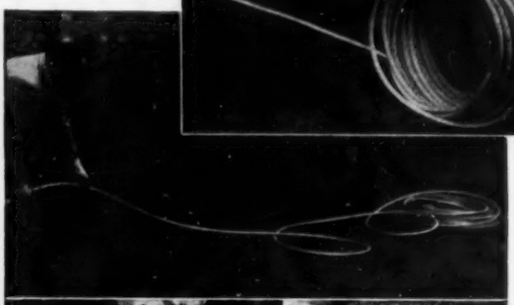

—and the wrong way

UNREELING. The right way, reel rotating freely

—and the wrong way

Good rope repays care in handling. Never allow kinks to form when UNCOILING or UNREELING a steel wire rope. Treat it like a hose pipe. A light coil of rope may be unrolled along the ground but should always be kept under control. A reel may be placed on a turntable or mounted on stands and supported by a bar or tube through the hole in its centre. In no case should a coil or reel be laid on the ground and the end taken over; kinks will inevitably form and the rope's life and efficiency be seriously reduced. When COILING down a rope always put in under-turns as required to counteract the tendency of the rope to twist itself. Under-turning is simple — the rope itself will indicate that.

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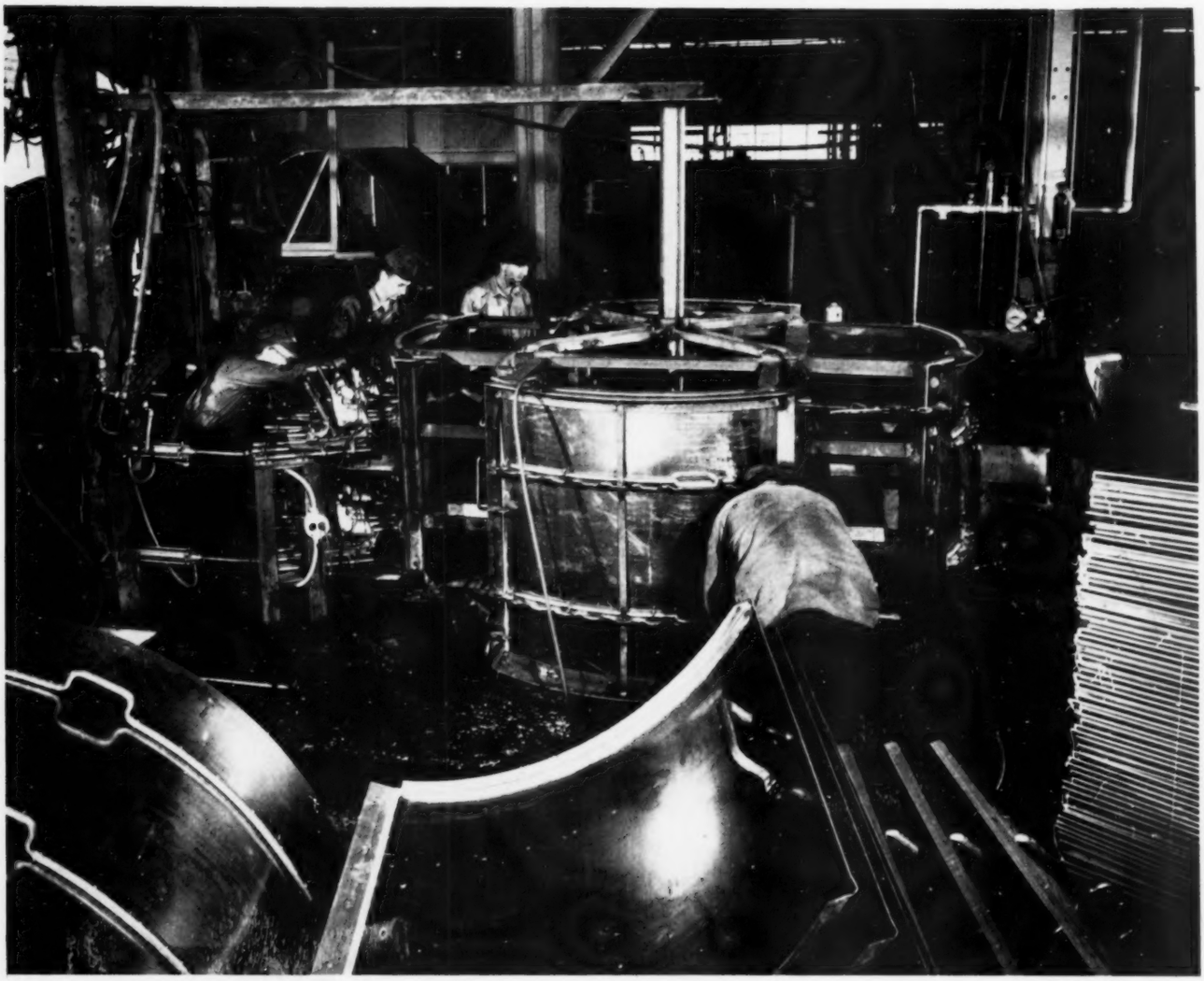

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